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ABSTRACT

The 35 papers included in these proceedings report on innovative approaches to teaching used by faculty members at Ontario's technical colleges and universities. Included in this collection are papers on optimum instructional methods using microcomputers, teaching French conversational classes through drama, competencies for the educational developer, software development guidelines, educational delivery models using computer databases, interactive audio, journals across the curriculum, electronic technology and the intellectual property enclosure movement, teaching information design, a practical solution for high student-teacher ratios, student journals as a method for achieving cognitive apprenticeship in writing in the social sciences, computer mediated communication, expert system shells for student-developed social science instructional software and for tutoring in cognitive neuroscience, interactive videodisc instruction, a method for interactive seminars, and computer-assisted instruction modules in soil science. References are provided in each of the papers. (GL)

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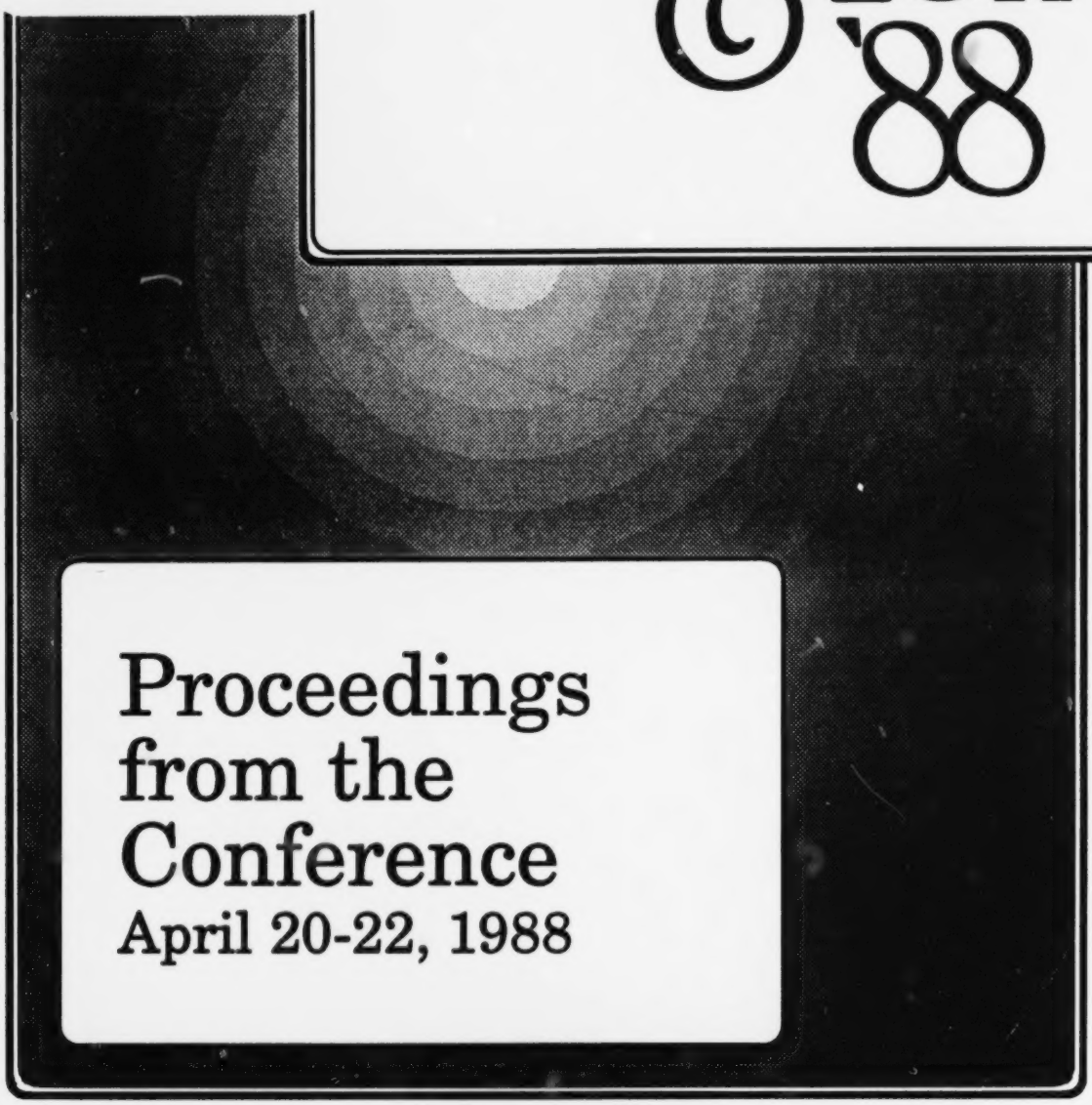

## Proceedings from the Conference
### April 20-22, 1988

UNIVERSITY of GUELPH

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# Preface

The Annual Ontario **Show & Tell** is an opportunity for faculty members at Ontario's various technical colleges and universities to share ideas, experiences and fellowship based on teaching.

This year the presentations included technological and pedagogical based experiences which were presented in what we believe is a unique yet effective format. Each participant gave a 15 minute general presentation (the TELL), and participated in a half hour demonstration/ discussion period (the SHOW) at which time interested individuals discussed specifics. In addition, each participant was given an opportunity to publish a report of their work in this review.

As you page through this volume, we, the organizers of the **Show & Tell**, believe that you will be impressed by the thoughtfulness, originality and concern about teaching expressed by the authors. Scholarship, as evidenced by these individuals, is demonstrated to be more than research within the confines of a discipline. It includes the questioning of what is done to and for students in higher education. The answers are interesting and important.

The organizers of the **Show & Tell** and editors of this volume wish to thank and commend the authors for their contributions to our understanding of how to effectively and efficiently help our students learn. We wish to thank them for their professionalism by examining teaching in higher education in a scholarly manner. We wish to encourage them to continue their important work, we have much to learn and are willing to learn with them.

Thom Herrmann
Coordinator
Show & Tell '88

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# Optimum Instructional Methods Using Microcomputers

**George H. Abdou**
Department of Industrial Engineering
University of Windsor

## CONVENTIONAL INSTRUCTIONAL METHODS

Analyzing present teaching methods, educational institutions are facing many serious problems. These problems can be divided into four major areas:

1. **Delivery Style:** The two primary learning modes are the textbook and the lecture. The instructor either writes down all the lecture material or reads prepared lecture. These teaching modes have three limitations:
   a. Lack of facilities to present complicated visualizations in class. In any science or engineering course lecture, less than half the scribblings can be represented by ASCII characters. Instead, a skilled instructor throws a set of sketches, graphs, equations, symbols and arrows, with no effort in conducting the class.
   b. Lack of facilities to refer back to earlier lectures.
   c. Student inconvenience due to less than clear instuctor's handwriting.

2. **Class Size:** The class size is limited to about 30 students. It has been estimated than in a typical class, only about 50% of students learn the present material. Today, inability to increase class size for some courses, is the dominant visible problem of educational institution. Such problem can be the restriction of admission of new students.

3. **Student-Teacher interaction:** Most students would prefer the interaction environment, rather than courses taught via teleconference. But, instructor takes about 50% of class time to write down the lecture on the blackboard, 30% to present the material, and 20% to interact with students. For three office hours a week, instructor can interact with about 15 students. Two problems are developed due to less student-teacher interaction:
   a. Insufficient number of assignments, quizes and examinations.
   b. Lack of learning experience to all students regardless to their background and learning speed.

4. **Instuctor's Time Management:** Too much repetitive efforts are involved in preparation for lecture and laboratories, year after year. A typical instructor's time management, can be 2 hours preparation for a lecture, 3 office hours for students' questions about the lecture or assignment, and 2 hours for grading the assignment. So, for a 3 credit hour's course (2-1.5 hours lecture a week), the time effectiveness (productivity) is 33% (3 hrs/(2*2hrs+2+3)). This figure does not include the TA's (teaching assistant) time to prepare and grade for the laboratory experiment.

## CURRENT ALTERNATIVES

Alternative methods have been applied, using the following facilities: overhead projectors, slide projectors, and audio and video recorder. They increased convenience, more contact with professors, better display of graphics and texts. Instructors have better control in conducting the class and provide more assignment and project work.

However, these methods generate more work and time involvement for each instructor in preparing for the lecture. They still carry some of the limitations of conventional methods, such as for delivery style.

Recently, other methods, using computers were applied. These methods are "telelearning", "electornic university", and "education outside classroom". They exist in mainframe computer and are managed by either electronic mail, a computer conferencing system or both. Students interacts with instructors and other members of the class by using a microcomputer and modem. Course are delivered electronically, using telecommunications as the link between instructor and students.



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Among the advantages cited by students are increased convenience, motivation to learn and more opportunity to participate in discussions. However, the major problem is lack of the effective feedback provided in live conversation, by facial expressions, postures, gestures, etc. That sort of information is what good teachers uses to monitor how a class is reacting to what is presented.

## MICROCOMPUTERS IMPACT ON LEARNING

A microcomputer is a computer employing a microprocessor. It is composed of a keyboard, a video display terminal, electronics and floppy disk drive(s) and/or hard disk drive(s), integrated into a complete, self contained computer system. Peripheral devices include joysticks, paddles and printers.

In some universities, courses are delivered on disk, with associated hard copy reading and study materials. The course disk contains a fixed set of assignments, and projects for the student to complete and upload to the instructor. This is classic microcomputer-based instruction. An element of telecommunication thrown in can make the process more convenient.

Software development is expensive. However, some institutions invest a great deal of money, faculty time, and programmer time in producing programs for specific subject areas. General use (commercial) software has been developed for students and researchers who need real time programs to communicate with laboratory devices. The packages provide scientific calculations, statistics data analysis, data acquisition, terminal emulation, laboratory interfacing, graphics and animation for most common applications.

As computers and associated technology stimulated major changes in an education system, the question became how should instructors present and introduce students to powerful graphics (CAD), programming languages, simulation and animation. But access to powerful software applications is not the fundamental need. Rather extension of computers to greater numbers of classes, expects the design of different varieties of instructional software that give clear demonstration to students for using computers in these applications. If microcomputer-based activities are to improve the teaching effectivness, these activities should take into account the complexities of instructing a different mixture of students in large group settings.

## MICROCOMPUTER-BASED INSTRUCTIONAL METHOD

Most universities began using microcomputers in teaching different subject areas. The typical university has more than 80 microcomputers. Although, these numbers are less than the resources needed, the university can provide, for all students, a substantial degree of computer-based instruction.

The following discussion with regard to some features of the microcomputer-based methodology highlights the significance of this paper. For a lecture presentation, Instructor can:

1. gather all types of picture images and text image files, by storing the contents of the active color and screen buffer into a specified file in a disk.
2. create professional display of inter-mixed high resolution, low resolution graphic and text frames on any microcomputer.
3. provide very interesting color graphic animation.
4. set colors for each frame with different background colors.
5. use the keyboard, paddles and joystick to show frames in forward and reverse order, or skip frame(s), if necessary.
6. add, delete, modify graphics and texts during lecture.
7. alter the display order of frames and the length of exposure, to accommodate unexpected changes
   in lecture material.
8. switch screen between high and medium resolution display mode.
9. reverse displayed image producing the effect of a negative image.
10. print hard copies of any frame.
11. select different dissolve types for the transition from frame to frame.
12. run the presentation in manual or unattended mode.
13. store up to 100 frames in one floppy disk.

The proposed method is to deliver college courses by using software application for presentation. Probably one of the biggest shortcomings of the current computerized conferencing systems now being used for education is the lack of graphics. It is currently difficult to deal with equation, diagrams in these text oriented systems. This application has potential advantages compared to other modes of educational delivery, including more active participatic )y students, increased number of assignments and quizzes, and

presentation of complicated visualizations.

## HARDWARE

The true portable computer, which the instructor can carry to a classroom, is called the Lap Top microcomputer. Because of their small size and weight, I found these microcomputers to be more portable than the many desktop machines. All of them uses double-sided 3.5" disk drive(s) that store 720K bytes. The processing speed varies. They include a composite port to connect a monochrome video projector. An RGB exists in some models to connect a color video projector or monitor. They includes a parallel port and a serial port, to connect a printer and a joystick, respectively. Table 1 shows a comparison of some of the Lap Top microcomputers.

## SOFTWARE

While few software has been created expressly for use for instruction, much of the existing software, including the most sophisticated, can be brought to the active screen and saved in a disk with the little software we have. Storyboard and Present are the two softwares that I can consider for general presentations (see table 2).

## APPLICATION

Similar studies have been conducted by the author at Northern Illinois University, Dekalb, Illinois, and the results look very promising. In view of increasing awareness of modern technology and its application in education, the ever decreasing cost of technology, and the possible shortage of faculty in areas like engineering, this method assumes phenomenal importance while also being feasible.

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**TABLE 1: Lap Top microcomputers**

| Company | Model | Weight lbs | RAM bytes | Storage 720K bytes | Clock Speed | RGB | Price $U.S. |
|---|---|---|---|---|---|---|---|
| Bondwell | Bondwell8 | 11.5 | 256K | 1 3.5" | 4.77 | Y | 1295 |
| Data General | DG's 2T | 12.0 | 512 | 1 3.5" | 4.77/7.16 | N | 1695 |
| Grid Systems | GRIDlite | 9.0 | 128 | 1 3.5" | 4.77 | Y | 1750 |
| IBM | Converter | 12.5 | 512 | 1 3.5" | 4.77 | N | 1995 |
| Kaypro | 2000 | 11.0 | 256 | 1 3.5" | ? | N | 1995 |
| NEC | Multispeed | ? | 640 | 2 3.5" | 4.77/9.54 | Y | 3695 |
| Sharp | Sharp | 10.0 | 256 | 1 3.5" | 4.77 | N | ? |
| Toshiba America | T1000 | 6.5 | 512 | 1 3.5" | 4.77 | N | 995 |
| | T1100Plus | 10.0 | 256 | 1 3.5" | 4.77/7.16 | Y | 1999 |
| | T3100/20 | 15.0 | 640 | 2 3.5" | 4.77/8.0 | Y | 4699 |
| Zenith Data | Z-181 | 12.0 | 640 | 2 3.5" | 4.77 | Y | 2399 |
| | Z-183 | 15.5 | 640 | 1 HD10MB | 4.77/8 | Y | 3499 |
| Wang Lab. | Lap Top | 14.2 | 512 | 1 HD10MB | 4.77/7.16 | N | ? |

**TABLE 2: Software**

| Company | Product | Computer | Price |
|---|---|---|---|
| Harvard | Harvard Presentation | IBM & Comp. | ? |
| IBM | Storyboard | IBM & Comp. | 369.00 |
| MLS | Present | IBM & Comp. | 40.00 |
| Software Publishing | Click Art | IBM & Comp. | 185.00 |
| Thirdware Computer | Finger PrintIIc | AppleIIc | 149.00 |
| Xerox Corp. | Destop publishing | IBM & Comp. | 895.00 |

**TABLE 3: Projectors**

| Company | Type | Weight lbs | Color | Price $ U.S. |
|---|---|---|---|---|
| ASK Lcd | flat screen | 3 | N | 1050 |
| Eastman Kodak | flat screen | 12 | N | 1270 |
| Telex | flat screen | 10 | N | 900 |
| Barco | video projector | 82 | Y | 15000 |
| Electrohome | video projector | 22-65 | Y | ? |
| Sony | video projector | 51 | Y | 6400 |

# From Reading to Writing: Making it Happen in the University Composition Classroom

**Pat Aitken**
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What classroom techniques will encourage first-year Composition students to develop better writing processes and products? In the English Department at Laurentian University we have developed a set of pedagogical and logistical practices to help students get from reading to writing, which of course is the process basic to university essay writing as well as to much employment-related writing. This set of practices helps us deliver a composition course based on two complementary theoretical principles: 1) good writing develops out of good reading; 2) good writing products develop out of good writing processes. We teach a simple method of critical reading, and we use a combination of techniques well-known in composition: heuristics, journals, peer editing, conferencing. Perhaps what is new in our methodology is just the combination of pedagogical and logistical techniques by which we integrate the teaching of process in critical reading and process in composition. Our text based on this combination, From Reading to Writing: A Reader/Rhetoric and Handbook, will be published shortly by Prentice Hall.

We came to our present approach to first-year composition via long experience and a concurrence of complementary critical stances among faculty interested in Composition. For many years we taught standard, grammar-based Composition: "bonehead English," with its handbooks and workbooks, rules and drills, and essays based on set topics and "modes" of writing such as comparison or cause and effect. We knew students were making many basic errors in sentence structure and other grammatical errors; we did our best to help using current/traditional approaches to the teaching of writing. After several years of part-time teaching, however, I was puzzled and frustrated by the readily apparent failure of my students to transfer their correct drill answers to their writing. Overall, their writing did not seem to be improving through the session.

In 1983-84 I embarked on a doctoral programme in composition and rhetoric at the University of British Columbia. After a year of studies I returned to Laurentian committed to an expansionist, neoclassical rhetoric defined as the study of effective communication, to modern composition theory stressing process in writing, and to rhetorical criticism in the tradition of Kenneth Burke, Wayne Booth, and my own teacher, Andrea Lunsford. I was surprised to find a new, process-oriented textbook in use in first-year Composition at Laurentian, and a new full-time colleague, Dr. Lawrence Steven, with an interest in Composition based on his own studies in critical theory and hermeneutics.

In 1986, after I was appointed full-time to teach first-year Composition, Dr. Steven and I, along with a group of interested full- and part-time colleagues, began to develop a new approach to the course which was "top down" rather than "bottom up." That is, it began with the rhetorical situation or "occasion" for

a piece of writing--its subject, audience, and purpose--and worked down to revising errors at the sentence level rather than starting to teach writing by working on sentence-level errors. As we worked, we realized that many of our students' problems began even farther back: they were not comprehending the reading materials out of which most of their essay writing at university level and beyond would develop. They could not write because they could not read. We would have to teach critical reading skills before we could even get to writing.

Then we began to see that we could put reading and writing together by showing students how parallel the two processes were when approached rhetorically. If the student attempted first to understand the rhetorical occasion out of which a text developed--its subject, audience, and purpose--she could work through various stages in that understanding to an interpretation of the piece which would emerge into a piece of writing of her own developing out of its particular rhetorical occasion. Many of the same steps in a critical reading method or tool could be used to organize the student's own piece of writing.

We teach critical reading, first of a single text, then of a group of thematically-related texts, using an analytical tool we call the "Active Reading Method." Since we have discovered that many students' idea of reading something is to move it passively before their eyes, we teach "active reading" (analagous to active listening, as taught in interpersonal communication theory); that is, we demonstrate in the classroom how students should mark up texts they are reading right on the page (something past schooling may have discouraged), not with highlighter, but with pencilled-in arrows connecting repeated ideas, images or key words, stars, question marks, division marks and numbering, marginal paraphrases of key points. Thus active reading marks the beginning stage of a working understanding of a text.

Next, we ask students to complete their active reading by making a page or so of notes for each text they read; they keep these notes in a special notebook, the Reading Workbook. Each entry in the workbook consists of six steps constituting a critical analytical method or tool that can be used on any piece of expository writing. In the first weeks of our course, we demonstrate each stage or step of the analysis in the classroom using a simple, straightforwardly organized single text. The first step asks students to identify the subject, audience, and purpose of the text as specifically as possible in relation to the particular text. Secondly, students find the thesis statement of the piece: the sentence or small group of sentences that either open up the rhetorical occasion of the piece or encapsulate its controlling idea. The third step is to identify and supply instances from the text of "developmental strategies"--the old modes--such as example and illustration, definition and so on, by which the thesis of the text is developed. Fourthly, students outline the piece diagramatically, dividing, numbering and titling main sections and subsections of the piece, so that they create a two-level outline which distinguishes between main and lesser ideas in the body of a text, ideas in support of its thesis.

The fifth and sixth stages in the "Active Reading Method" are climactic and pivotal. The fifth stage is a summary, in which students are asked to reduce the text to its essential points: probably paraphrasing the thesis and main supporting points, as discovered and recorded in previous stages of the analysis. The summary thus gathers up the student's understanding of the text. The final stage, the response, a minimum of 100 words in length, moves the

student from reader to writer, towards overt assimilation of his understanding of the text with his own experience: in other words, towards interpretation of the text. The response may be tangential ("That reminds me of"), stylistic, evaluative; it may supply further examples or illustrations, comparisons, implications, or other forms of reply. The response may be narrative: a history of the student's response, moving, perhaps, from immediate, emotional, negative reaction, to later, more rational response. A student may respond to only part of the text or to the whole. Students are expected to support assertions in their responses with evidence from the text. Both summaries and responses are read aloud in the classroom or written out on the board for comparative purposes. Students are amazed by the variety, the conflicts in summaries and responses. Instructors must handle these carefully, guided, as must be apparent by now, by the very evident potential for conflict and confusion, and by their own critical stance. Note, for instance, that summarizing assumes that, "pace" deconstructionist views, discernable meaning does reside in the text to some extent, while asking for individual response assumes that reader-response, if persuasively defended, has validity.

We find that demonstrating the Active Reading Method can be effectively augmented by having students examine student examples of Reading Workbook Entries for particular texts, and by having them do exercises in which they practice the individual stages on other texts. Early checking of the students' own Reading Workbook and eliciting students' own work in the classroom also help ensure that students understand what is required of them for each stage.

As stated earlier, the response is the pivot. To move from the reading occasion into the writing occasion (the assumption being that the student is going to write an expository piece of her own after completing the reading of a text or texts), the student actively reads her response, treating it as a text. This reading will highlight key words, images and ideas, suggestive and germinal examples, comparisons, or implications which can become the raw material for her own essay.

Now teaching of the process of expository writing has begun. Rediscovery of classical rhetoric is one factor promoting the active teaching of process in writing (Empirical studies over the last two decades of writers in process of writing have been another.) The "canons" --parts or stages--of classical rhetoric as set forth by Aristotle in the Rhetoric and elaborated by Roman rhetoricians like Cicero and Quintilian began with invention, a stage forgotten over centuries as the province of rhetoric contracted, until rediscovered in the twentieth-century renewal and made part of composition theory, principally in the American discipline of composition. Our method for teaching critical reading combined with expository writing in introductory Composition courses thus uses the response as one inventional technique; one technique, that is, for generating material for an essay. Earlier composition textbook pedagogies, born in mid-nineteenth century American colleges out of a new need, because of growing numbers of university students, to replace earlier oral examinations with written, stressed the second classical canon, organization of the essay("Find a topic, narrow the topic, write a thesis and an outline ) while ignoring invention completely. Few Composition texts before the mid-nineteen seventies gave any hints as to where the material to be organized was to come from or how it was to be generated.

To teach invention we add to active reading of the response other 'heuristics" or exploratory tools. Some are by now well-known, such as the journalistic pendad "W5," brainstorming, and freewriting. Others, such as Kenneth Burke's "dramatistic pentad" and the "tagmemic heuristic" of Young, Pike, and Becker, are less widely suggested in texts but equally useful. Still others derive directly or indirectly from classical rhetoric, such as Aristotle's "topoi," or Richard Weaver's hierarchy of topics. We teach and demonstrate these methods to students in the classroom, showing them, for instance, how quickly several blackboards or overhead acetates can be filled up with ideas generated by brainstorming.

We then move to organization (always remembering that the entire composing process has been demonstrated by a generation of empirical composition researchers to be recursive, moving in the individual writer's composing process constantly and idiosyncratically backwards and forwards among the stages and levels of the process). Now we are able to show students that the same analytical tool, the Active Reading Method, which they used to understand a text or group of texts can help them organize their own piece of writing. Once they have accumulated a great deal more material than they can possibly work into their essay using a combination of inventional heuristics as well as their responses to readings, they can begin to construct the rhetorical occasion for their own piece of writing by deciding on their own subject, audience and purpose, their thesis statement, the developmental strategies they will employ, and the outline of their piece. This preparatory work, all done in writing in contrast to earlier textbook directives to "Think it out, then write it out," is referred to in composition theory as Prewriting. We get our students to do it collaboratively in the classroom at first, then individually for every piece of writing they do. Often we ask them to talk about their prewriting in class or put TS and outline on the board. Sometimes we use small groups to vet this work; at other times we use what I call a "go-around," in which every student in turn is called upon to describe his planning.

We teach drafting principally by requiring it to be done before a final version of the essay is handed in. This requirement has many implications. First, it creates the possibility, considered essential by professional writers, for student writers to "incubate" their essays, i.e. sit on them (!) for a while, so unconscious processes can have time to work and come to consciousness as insights, and also to revise their work globally, i.e. not merely proofread or even "edit" their work as they produce the "good copy," but to reconsider their work from the conceptual level right through organization, sentence structure and rhetoric, and mechanics. Secondly, it creates a situation in which a provisional version of the paper has been created, which can be shared, both with a group of peer editors and with the instructor, for evaluation but not for grading.

Thus enters the scene the writing group, an essential but demanding feature of our pedagogy. The writing group offers many advantages, perhaps most obviously to less talented writers, but to better writers and instructors too. Good students learn by helping others; their own writing improves as their critical facility increases. Instructors gain when students gain and when teaching can be done without their having to stand up front and lecture. Many students of varying abilities learn better in small groups and from each other than by lectures. But the writing group is not without its peculiar pedagogical challenges.

The first set of problems in dealing with writing groups involves motivating the groups and getting them started. Groups need to be convinced that doing all this extra work will result in better writing products--and marks. Instructors can meet this need by showing some of their most convincing examples from previous sessions. Groups will also protest that they are not competent to judge the work of others: does not their presence in the intro comp class (the result of a test failure or requirement in many universities) prove their incompetence? Yet instructors can point out that in analysing a text and doing preparatory inventional work collaboratively the class has already learned a vocabulary to use in discussing drafts. Students can also be assured that they will be given limited criteria for judging each paper, that some of their most valuable discussion, according to theorist Peter Elbow will be about just the topics of their papers, and that their instructor will set them a specific process and definite tasks and be available to adjudicate disputes or suggest alternatives.

Forming the groups also requires careful thought. I have found that groups of between four and six work well; a certain critical mass is required for good group dynamics. It is also well to get diagnostic pieces of writing before forming the groups, because groups work well if they can contain at least one reasonably good writer. The instructor should also try to assess leadership potential in the class and put at least one "leader-type," meaning a facilitator rather than a dominant figure, in each group. Mature students often fulfill one or both of these functions--good writer and good facilitator. Try not to isolate these figures in groups since immature groups can be swayed against them by uncooperative types. Much depends on the atmosphere and dynamics set up in groups. Instructors can intervene to solve occasional task or process problems, but they can't be everywhere at once.

The first meeting of a writing group should probably be devoted to some group-building activity rather than, or perhaps in addition to, the first tasks they must perform on the drafts themselves. Discussing the prewriting work for the draft may fill this bill.

Instructors also need to think about the logistics of making writing groups work in the intro comp classroom. Students need to make sufficient copies of their drafts for the members of their group plus one for the instructor. This means they must have met with their writing group before having to bring their draft copies to class, or at least know how many will be in their group. They need to exchange copies with members of their group, they need to analyse those exchanged copies, and then they need to discuss them. Conceivably this activity could all be carried out in the same class meeting; say a three-hour session blocked off into periods for exchange, individual work on exchanged drafts, and discussion. But we have found it more satisfactory to separate these stages.

So we normally have first a meeting of groups to exchange drafts within groups and read them aloud. Writers may read their own or become readers while another group member reads their paper. At this time the valuable discussion of subject/topic can take place and small corrections can be made to the drafts. It is probably best to discourage detailed analysis at this stage, although initial reactions from a "live" peer audience can open many a student eye.

Then students take away the exchanged papers from their group to analyze them individually on the basis of some set of criteria established by the instructor. Once again the Active Reading Method can be put to work, or some other check-list of possible features may be used; additionally we often ask for an evaluation of some strengths and weaknesses in the papers. We find it valuable to ask students to return to class with this work done in writing on the exchanged papers. This work may need to be checked by the instructor. Its purpose is to serve as the basis for the oral discussion of each member's draft which is conducted at a subsequent (usually the next) class meeting. Arranging for the separate meetings of the groups for exchange and then for discussion with at-home time for individual analysis in between takes some careful thinking through on the part of instructors whose classes meet just once a week.

Instructors can enhance the quality of feedback given in writing groups by several means. They can ask students to consider their own experience of receiving feedback or evaluation: what kind of responses from instructors or others were more and less helpful. They can also teach students a simple system of marking symbols, perhaps most sensibly the one they use themselves, ideally that found in the composition textbook they are using. Finally they can set clear criteria for the analysis of exchanged copies: some general guidelines for the individual written analysis, and perhaps a particular emphasis for their evaluation, related to the stage or level of revision the instructor is currently stressing. Students should not be asked to do too much with the exchanged copies. Above all, they should be restrained from correcting and urged rather to point out problems they experienced as readers, indicating where the writer failed to communicate effectively to <u>them</u> and some possible options for revision.

Attendance at both exchange and discussion (drafts workshop) meetings of the writing groups is crucial. The whole concept of peer editing and evaluation can be undermined by students who in spite of all our efforts either fail to see the value, have job or extra-curricular commitments, or simply decide not to do the extra work. We have found it necessary to invoke the general attendance regulations in our own university calendar to fail students in our intro comp courses who miss more than 20% of scheduled class meetings. We also refuse final papers when their authors have not participated in the exchange and analysis of drafts.

Students do lead complex lives today, so I have found ways of facilitating the exchange of drafts. Attendance at the exchange session is less critical than at the actual workshop discussion. What is required is that students produce draft copies in time to be exchanged on schedule with their groups. I often grow a "drafts tree" which spreads across my office door, a tree of envelopes

addressed from and to individual members of groups and containing draft copies that need to be exchanged in time for at-home analysis and later workshop meetings. If I taught in a single classroom, I might arrange a file drawer system; or perhaps the Department office might be a more accessible locus for facilitating exchanges.

It isn't just attendance at writing group sessions that is critical; it's also participation. It is important to set groups specific criteria for evaluating drafts, which can become the basis for discussion. If necessary, say with younger, less motivated groups, instructors can be fairly directive in moving into groups to ask leading questions, making sure no one is dominating discussion or derailing it, keeping time so that all papers get equal discussion, and setting specific tasks to be reported back to the whole class after the group workshop session. These tasks can be fairly simple and related to the area or level of revision the instructor wants groups to stress; for example, they make get groups to report an effective sentence from each member's draft and defend their choice. Instructors at the university level may want to consider giving specific marks for process-related tasks like producing drafts, analysing exchanged drafts, and effective participation in drafts workshops. This is certainly being done in process approaches to writing at the high school level; in our own case at Laurentian we have thus far resisted doing so.

Writing groups can be used in other ways besides peer editing of short essays. They can do group invention, revision exercises, group "go-arounds" to report on prewriting. They can take sections of essays too long to photocopy in their entirety for the group, such as the research paper, and analyse and discuss them.

When writing group discussion is complete and reporting has been done, the instructor can use a period of time to teach points that appear general throughout the class. We teach the concept of revision by stages, moving from "large" to "small" matters, i.e. from global revision of an essay to revision of mechanics.

Once final drafts are in their own good time produced, the process appears to come to an end: the product must be marked on its own merits. But it does have a few further uses in the intro comp classroom. It can be returned to the writing group to demonstrate what their work has accomplished. It can be read aloud and its effectiveness in the instructor's eyes pointed out. Ideally, outstanding products can find publication somewhere. For this reason instructors may want occasionally to move away from thematically related groups of readings found in textbooks to "found" texts related to current issues of interest to their students. In such circumstances publication of writing products can be a means of contributing to campus debate as well as making expository writing a "real" exercise in effective communication within a particular rhetorical context. It must be admitted that such topical sequences from reading to writing may be more appropriate for intermediate or advanced composition courses.

I have just described the combination of logistical and pedagogical methodologies by which we move from reading to writing in our introductory

composition classrooms at Laurentian University. Complementary techniques used in most process-oriented Composition courses remain to be discussed briefly.

Most process-oriented Composition courses require students to keep a separate notebook in which they do regular, informal, ungraded writing, usually called journal writing. The rationale for this activity is that all writers, but particularly beginning or unsuccessful writers, benefit from writing a lot, and from doing writing in which the bogey of "correctness" need not appear over their shoulders. Certainly professional writers make extensive use of journals. Entries should probably be dated; we find three a week to be sufficient. Although secondary school English courses, especially at senior levels, now stress writing (and writing process) significantly more than in the past, the change is relatively recent in Canada. As a result many of our intro comp students have not benefitted from this change, either because their high schools had not yet made the switch or because they have been out of school for a number of years. We can hardly underestimate the lack of freedom, enjoyment, and ease in writing that many of our students experience. Journal writing, although viewed as something of a burden by some students, who see the course as already very heavy, offers many a way to experience the joy and satisfaction of communicating effectively to an audience of themselves.

Journals can be used in many ways, both in and out of the classroom. In class, students can be allowed time to use their journals for prewriting activities, both inventional and organizational. Some instructors may want this kind of journal material to be separate and detachable from the more personal journal entries, so they may ask for looseleaf journal notebooks. Of course prewriting can be done in the journal outside of class time as well; it can thus count towards fulfilling the weekly requirement of three pages. There are many other uses of journals either in or out of class. Students can be asked to fill pages with lists: favourite activities, heroes, things, etc. Or they can be asked to do a more classic diary for a week: "three days in my life." The whole class can be asked to do the same topic: dreams, money, leisure, using three different approaches to the topic during the week. It would be desirable to discuss the results briefly in class; it may lead to a better understanding of the uses of the "modes" or developmental strategies (methods of development). If journal writing is done in class, especially if it relates to essay preparation, students might do it sitting in writing groups. Instructors may want to ask students to bring their journals to every class.

Some instructors find the more personal journal writing more successful than the essay-related entries. The rationale for suggesting the latter is that it kills two birds with one stone. As previously mentioned, some students find the journal one of the more onerous parts of an already heavy course; others are happy to discover how it improves their writing fluency. Allowing some class time for journal writing is another way to ease the burden. Of course if students are writing in their journals in class, it would be good if instructors were doing the same thing.

This brings up a related point. Should you introduce your own writing in the composition classroom? Opinion among composition theorists is divided on

the issue. Some advocate the practice on grounds that it shows the instructor as a working writer; others worry that it may intimidate students. Perhaps the answer depends on how comfortable the instructor is in bringing her own work into the classroom. Ontario language consultant Gwen Mowbray told a recent conference of writing teachers that she often brings in a piece of her own and asks for help (the request must be genuine, Mowbray stresses) with a word or sentence. One thing seems clear: many writing instructors in fact do not write a great deal themselves, and certainly they very seldom place themselves under the sorts of conditions they regularly impose on their students.

To conclude our discussion of journals in the introductory Composition course, it should be noted that although the journal is conceived in principle as private writing, to be shared only at the intiative of the writer, if it is a course requirement it must at least be scanned by the instructor regularly, if only to see that it has been done, is genuinely the work of the student, and was probably done on the date indicated. This requirement adds further to the already heavy marking burden in a process-oriented composition course. Some instructors have found, however, that briefly scanning the journals every two weeks or so, as well as having some journal work done in class, reduces this burden considerably.

Finally, a brief note on conferencing in the process-oriented composition course. We use brief individual conferences with students twice during a session in our intro comp course. The first conference comes in conjunction with the first short essay of the session, either after the final drafts have been returned or, on the recent suggestion of an instructor in our course, after the writing groups have discussed and analysed the drafts. Much depends on the size of the class. We suspend regular classes for a week twice during a winter session: once for the first essay conference and again to confer on the research paper draft. The conference can be used to do brief remedial exercises, reteach points students have apparently missed, impress upon students the necessity of meeting deadlines and other requirements, and above all, to answer student questions. For the research paper conference, a system of marking the draft can be used to point out places where the instructor particularly wanted to comment.

We were pleased to have had the opportunity of the Academic Show and Tell sponsored by the Office for Educational Practice of Guelph University to share with interested Ontario university faculty the classroom and logistical techniques we have evolved to move students from reading to writing. There is now ample evidence in composition research that process is an approach that can produce better student writing. But if process is going to succeed in the classroom it must be translated into workable methodologies. Pedagogy has not had high priority in Canadian universities. But instructors in Composition and many other disciplines are coming to see instruction in critical thinking, critical reading and process in writing as a way to enhance learning across the disciplines. We need to understand the importance of interpretation in many disciplines and the key role of writing in all disciplines and at all levels of university instruction. We hope our ideas and experience can help others.

# Teaching French Conversational Classes Through Drama

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Drama has always been widely used as a pedagogical tool. Its relaxation techniques combined with voice training make it appealing for oral language classes. Faculties of Education have always included drama in their curriculum for future primary and secondary teachers. At the university level, professors such as M. Rassias (Dartmouth College, Mass.) rely heavily on acting to teach basic language concepts. However, it is only recently that teachers and professors have made the most of drama. In Germany and Scotland, the methodology varies but the idea of using drama is the same. First, we shall briefly examine how drama techniques are used in these countries. Then we shall present our methodology for French conversational courses at Waterloo, and finally, we shall discuss the results.

The principal idea behind the use of drama in teaching a second language, in the countries mentioned above, was to give the students a practical approach to the language, be it at the beginner's level or at a more advanced one.

Let's have a look at Germany, in the Centre de Didactique des langues étrangères (ZFI) de l'université de Hambourg;* the instructors wanted to reactivate passive acquisition of French, by giving the students the opportunity to use their knowledge to write a play and then perform it. They did not work on this in formal classroom meetings, but rather on two weekends. The first one was for a brainstorming session to determine the

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*Français dans le monde, No. 211, Août/Sept. 1987, p. 51.

themes for the future plot. This was followed by the elaboration of the characters, and finally the production of the first draft of the play. The second weekend involved writing the final script and performing the play. This extremely intensive approach allowed the students to use their creativity and combine it with both written and oral practice of French. The German experiment proved to be very valuable for students who had had previous instruction in French. However, such a workshop would not be as valuable to students who have absolutely no knowledge of a second language. So, how can an instructor of beginners use drama to serve his or her objectives?

Charlyn Wessels of Stevenson College, in Edinburgh, has developed such a method for beginners. She describes it in her book entitled Drama.[1] By using acting techniques of relaxation, vocal training and games, she creates an atmosphere of friendliness that gradually makes the students' initial shyness and fear of being ridiculous disappear. Once this positive atmosphere has been created, she works on role plays and finally on excerpts from famous contemporary dramatic works (for example, Twenty One-act Plays: An Anthology of Amateur Performing Groups, (Garden City, New York: Doubleday, 1978)). According to Ms. Wessels: "A drama project can build appreciation and understanding of the culture and codes of behaviour of the target language -- so it can reduce resistance in the learner towards that language."

Having seen two different approaches to drama as a tool for language teaching, both with such excellent results, I was convinced that our department could offer something similar. We had already worked on a play

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1 Charlyn Wessels, Drama, Oxford University Press, 1987.

for "fun" with some third and fourth year students. We were so impressed by their performance that we decided to create a more structured course that could offer the students valuable communication skills (in French), a certain confidence, and a taste for French contemporary drama. FR 208(D) was born.

The course is not a literary one, even though drama can be used in teaching literature as Charlyn Wessels has shown in her book. What we wanted to do was to take a conversation class and transform it into the production of a French play (or plays). There were several difficulties along the way. First, we needed to find students looking for something different, because the evaluation of the course would not be as "mathematical" as other courses (no tests, no midterm). Second, they should have had some exposure to French before, and should have a relatively good reading knowledge and understanding. Third, it is difficult to find a short contemporary play with plenty of conversational interaction, many parts of equal lengths, and which is, as Charlyn Wessel says, "large enough to justify the language-learning aims of the project." Finally, finding rooms that can be re-arranged easily is sometimes a problem. Ideally, the use of a drama studio is best. Once we had overcome these difficulties, the course could take place. The students must attend all classes (four hours a week) divided as follows: three hours are dedicated to the production of the play, and a one-hour seminar on "Drama from ancient times to the XXth century." This part of the course offers the students general background on the topic. The class is given by Faculty members of different departments whose interests in literature, including drama, cover all centuries.

Each session starts with relaxation techniques, breathing exercises, and

warm-ups, ending with games involving physical contact.

Warm-up exercises

A. Most people are familiar with these exercises. They include shoulder rotations, posture exercises: stretching (for example, "apple picking"), rotation of the waist all done very slowly.

B. Posture and breathing exercises, such as: standing up, legs apart, breathe and lift the arms on the sides, breathe out and lift the arms above the head. Reach for the ceiling with each arm. Breathe in, lower the arms to the shoulders, breathe out, arms down. Relaxation of the jaw muscles is very important. Any tightening of the jaws will interfere with proper breathing and sound production.

The following exercise combines both muscle relaxation and sound production. Take two long deep breaths. Breathe in through the nose and out through the mouth. (Breathe in and count 1, 2, 3. Hold the breath for 1, 2, 3. Breathe out 1, 2, 3.) Breathe in and out saying 'ahhhhh.' Same thing with 'ouhhhhh, ihhhhh, euhhhhh.' Now, add an m - 'mahhhhh,' n - 'nihhhhh.' Then let your voice go up in pitch with the 'mahhhhh' sound on one breath. Same thing down. Repeat 3 times.

Another exercise which the students find amusing helps to release the tongue tension. Open your mouth, pull out your tongue and count, or try to count, to ten with your tongue out. Finally, relax your whole face, screw it up very tightly, release, repeat. We end this muscle relaxation by massaging the whole face with the finger tips.

It is now time to move on to tongue twisters, such as: "les

lentilles ragaillardissent-elles? Pourquoi les lentilles ne ragaillardiraient-elles pas?" Such exercises help the students to open their jaws, and give better sound production. The instructor starts with one and the whole group repeats twice. Then at random, students are chosen to repeat it alone, in pairs, or in threes... Later, the students take turns inventing their own tongue-twisters.

Charlyn Wessel has mentioned a particular exercise that I like very much. It is poetry reading. Choose very short poems (ten to fifteen verses maximum) and have each student recite one verse. The whole group moves freely about the room, each student reciting one verse in turn. This gives the students time to practice diction, enunciation, rhythm, and pronunciation. Charlyn Wessel suggests that "it can also be read as choral poems (some lines given to female voices and the others to the male voices of the class)."[2]

C. For the final segment of the warmups we include some aerobics.

a) Kick one leg, then the other in front of you, arms stretched in front of you pushing some imaginary wall.

b) Then, in a circle, each participant chooses an action (jumping, pretending to be an aeroplane, a train, a lumberjack and so on). One person goes to the centre and does his/her action, everybody mimics it and he/she leaves the centre, goes back to the circle and someone else comes into the centre. There should be no interruption in action and the pace should be fast.

c) When everybody is really wound-up we play a couple of games.

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2 Ibid., p. 71.

"The wall," for instance. Students divide themselves in two groups (three minimum). They line up beside each other, arms spread out, fingers touching each other. There is a caller who determines if there is a wall or a street. By pivoting their bodies to the right or the left they make a wall or a passage. Now, two students (cat and mouse) chase each other. The caller should make quick changes of the wall or passage. The mouse can enter the wall and take the place of one of the "stones." The stone becomes the mouse.

An other game is "The hare and the fox." In pairs, people make bridges with their arms. Each bridge represents a hare's burrow. Every time the hare jumps into the hole, it is safe, and one of the bridge holders becomes the hare, and so on.

Finally in a circle, students run on the spot very slowly, then faster, closing the circle at the same time. When they touch each other, everybody bends towards the centre and shouts at the top of his lungs a single word chosen prior to the exercise. This exercise is excellent as a final release of tension.

It may seem silly to do the games mentioned above, but these students live in a society that allows very little physical contact and consequently find it very difficult to touch each other on the stage. All this preparation should not be neglected: it is very important to do it at each session. After the physical warm-up, students find that they are ready for action, so to speak, and it is then that we move on to the brainstorming sessions.

These sessions are very valuable for defining the characters of the play,

who they are in real life, what they look like, what their hobbies are, their favourite author and so on. After such sessions the students have a better feeling for each character which helps them to choose the part they want to play. These brainstorming sessions last only the first two weeks of classes, and are later replaced by actual rehearsing of the various scenes. (It is very important to write out a detailed schedule of who is rehearsing what, when.)

Each rehearsal starts with reading the parts aloud, and students should be given the opportunity to try each one. Then they improvise freely on what has just been read; this helps determine how each student feels about the part by showing spontaneity, humour, emotion, and so on. Following this improvisation they read the scenes again keeping in mind what has been said and felt about the characters. At this time, I also ask them to exaggerate everything. This part of the rehearsal lasts about an hour and a half.

Preparing a play is not only a matter of learning a part and performing it. It involves also the technical aspects of the productions. Usually we spend a few minutes at the end of each class discussing these aspects (for example, posters, advertising, and programs). The students are entirely responsible for the advertisement for the play, the costumes, sets and props. In Waterloo, we are very fortunate to have a Drama Department that helps with lighting equipment and props.

After the eighth week it is necessary to have extra rehearsals. Those are done in small groups (two or three students) to give each student individual attention and help her or him overcome certain problems (for example, pronunciation, or use of space) and add finishing touches. The dress rehearsals are essential and should be considered as seriously as the performance itself.

Finally at the end of the term, the students perform the play. It is very important to do it more than once. One or two days before the performance we invite other classes and teachers to see the play. This gives the students even more confidence.

We try to build that confidence during the twelve weeks of the course. Being together for four hours a week is not usually sufficient to create strong enough emotional ties between the students. One of the reasons for the success of such a course is that students know each other well. The only way to achieve this is to get them together as often as possible outside the classroom environment. Full participation in all the activities is compulsory. Students know this when they register for the course. These activities are of two kinds: social ones, such as potluck dinners and going out for dinner, and the drama-related ones, such as plays in Toronto (Théâtre français de Toronto), French films at a local theatre, Ballet and Mime shows. These are always followed by a sharing of impressions. In being together we create an intimacy that will help the students on the stage.

Because students receive a credit for the course, there must be some formal evaluation of their work. Seventy percent of the mark is based on participation. Participation involves being present at all classes and all activities, memorization of a part, creativity and involvement in the technical aspects of the production. Thirty percent is based on a project in French related to any aspect of the Theatre Arts. It is presented orally, and the mark also reflects the student's linguistic achievements in vocabulary, syntax, and phonetics.

Having discussed the course and the evaluation, we come now to the results. They are of two kinds: tangible and intangible progress made by

the students in the target language.

The most noticeable progress was in the pronunciation. The tongue twisters combined with intensive repetition of the lines and constant correction from the instructor, helped the students master certain pronunciation related problems (correction of the l, the r, and of certain vowels). All this helps not only the pronunciation, but also prosodic features such as rhythm and intonation. In regular conversation classes we often have to deal with students with these problems, and it is not always easy to correct them. Learning and repeating the lines helps the students immensely. If one particular student does not seem able to overcome the difficulty, it is possible to tape the part for him/her and ask him to listen to it over and over at home. This is also recommended in case of a character having a distinctive accent (southern France, for instance). Although we have emphasized pronunciation, rhythm, intonation, the students also gained a lot from the lexical and syntactic points of view.

Acquisition of new grammatical structures, new vocabulary, a better pronunciation and good prosodic features were all acquired by the students at different levels; but what they really gained was confidence, and, to me as their instructor, that was the true objective. It is true that some were more at ease than others at the beginning but they all benefitted from it. It gave them a taste for French contemporary drama; but also a feeling that French was not only a tool to get a job, not only words to memorize, and rules to learn, but something one would have fun with and love to use.

# Education and International Development
# The Black Dragon River Consortium

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## INTRODUCTION

In a recent issue of the Financial Post newspaper (November 17, 1986) correspondent Wayne Gooding wrote the following assessment of China's desire to modernize.

"China can't afford to be consumer-driven as this would mean wasting too much foreign exchange on household gifts such as televisions. Rather, it wants capital goods, resources, technology and intellectual expertise, items that will serve the cause of economic development and the well being of 1.1 billion Chinese." (1)

To this end, the Chinese government has been actively seeking assistance world-wide from governments and private companies, to carry out their massive scheme for gradually blending the best of two systems, "socialism and capitalism."

"Canadian academic relations with the People's Republic of China began to develop soon after the two countries established diplomatic relations in October 1970. Since then, academic exchange activity with Canada has evolved through three phases - beginning in 1973, in 1979 and in 1983 - each of which has resulted from new initiatives of the two governments." (2)

It is the third phase which will be outlined in this report since the Black Dragon River Consortium (hereafter known as BDRC) is a direct result of this third phase initiative.

## HISTORICAL OVERVIEW

"Phase One began with the Canada/China Student Exchange. The Exchange began to operate in the fall of 1973 and quickly became the most regular vehicle for academic exchange contact between the two countries." (3) Other academic exchanges did occur from 1973 to 1979 but with less formal and less successful results. English training programs were deemed necessary before the Chinese could fully benefit from future exchanges.

Phase Two began to change our relations dramatically in 1979 when the Visiting Scholars Program was introduced. This program saw over 2500 Chinese scholars visit Canadian universities and colleges "for two years of non-degree advanced study and research principally in engineering, medicine and the sciences." (4) By 1983, twenty-four Canadian universities were involved in negotiation for academic exchange agreements which would involve more in-depth exchange activity.

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(1) Gooding, Wayne. The Financial Post Division of MacLean Hunter Ltd. - Special Report China and Hong Kong Section 4. "A Tale of Two Systems". p. 37, November 17, 1986.

(2) IDRC - TS54e (vol 1) - Canadian Academic Relations with The People's Republic of China Since 1970, Vol 1 "Findings and Recommendations" by Martin Singer - Faculty of Arts and Sciences, Concordia University, Montreal, Quebec, Canada. p. 2-3.

(3) IDRC - ibid. p. 3.

(4) IDRC - ibid. p. 3.

Phase Three began when funding, the major stumbling block, became possible through efforts by the Chinese, the Social Sciences and Humanities Research Council of Canada, the International Development Research Council (IDRC), and C.I.D.A. "The result has been a proliferation of institutional linkages..." which has included several long-term projects, Chinese students enrolled in Canadian degree programs, increased collaborative research and many more Canadians travelling to China as lecturers. (5)

## PROJECT OBJECTIVES

The BDRC project aims to provide both HALRU and LHTC with a package of training ,technical and material assistance designed to increase their training capacity and technical knowledge. The four components, which were identified by a project team in 1983, were established after Canadian personnel visited both institutions and evaluated needs of those institutions. The needs of the Chinese and what they wanted tended to be somewhat different depending on whose eyes one was seeing with. The obvious "wish list" and the desire of the Chinese for advanced technology was deemed as unrealistic within the terms of the project as seen by the evaluation team. However, the project set up the following four components which would allow both Chinese and Canadian scholars the opportunity to size each other's systems up and provide an initiative of academic exchange to build upon in the future.

1. Component one involves Training. This training is actually an attempt to re-educate rather than train in the true sense of the word. It seems that the M.Sc. and Ph.D. studies, as well as the non-degree courses and research visits for one year by young academics are an attempt to introduce them to our system of learning while at the same time, providing them with specializations in fields of study that will be useful upon their return to their institutions.(6)

Senior academics will also visit Canada on four week study tours. These visits will be based on specific topics or areas of expertise but will also attempt to familiarize the Chinese with our academic and social system. (7) The hoped for result of this will be to develop linkages with institutions and individuals in China and Canada. A second affect will be to break down another "Wall of China" which might ordinarily result when the young faculty returning home meet resistance from senior faculty and administrators when they try to implement ideas they've learned in Canada. By bringing older and younger generation academics together in Canada at our institutions for on site experiences, conversations, cultural exchanges, short course programs and social relationships, the rapport, hopefully, will create a bond and mutual understanding between Chinese and Canadian participants.

2. Technical assistance includes such things as upgraded English training programs, in Canada and in China, for participants from each Chinese institution. This training will provide the Chinese with the ability to communicate verbally and in written form at a level necessary for technical and advanced lectures in the classroom. English books and journals are becoming more commonplace and in demand in HALRU and LHTC libraries. The English training facilitates a second phase of the technical assistance component. (8) In addition to allowing young Chinese the possibility to study in Canada, English training also enables us to send Canadian academics on Curriculum development visits to either HALRU or LHTC. While in China, Canadians deliver a series of 12-14 lectures on topics agreed upon by Chinese and Canadian participants in the project over a 22 day period. The purpose of these lectures is "to inject intensive doses of new curriculum for assimilation into HALRU and LHTC courses pending the training of Chinese academic staff in Canada. Canadian participants are asked to send presentations six weeks in advance for translation into Chinese and for distribution at the time of the lecture." (9)

"Many critics would argue that a four week visit to China is too brief and that a minimum of two years should be devoted to such an input. The advantages, however, appear to outweigh the disadvantages. Short-term visits and an intense period of presentations have been well received by the Chinese who have adjusted their regular schedules to accommodate the Canadian visitor. The problems of isolation, severe winters, minimal disruption to research programs, moving personal effects, and family considerations are minimized, and the fact that more topics can be covered by more people provides strong incentives for short term and fast moving programs. The great barrier of language may only be tolerated for 4 weeks." (10)

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(5) IDRC - ibid. p. 4.
(6) C.I.D.A. - Plan of Operation (HALRU & LHTC). Black Dragon River Consortium (#282/08303) and (#282/08302) p. 4-13 (HALRU) pages 4-17 (LHTC), October 1984.
(7) *ibid
(8) ibid
(9) ibid * paraphrased extracts (9-15 endnotes)
(10) ibid

As can be seen from this evaluation by Dr. Neal Stoskopf, who was a part of the project team who visited China in 1983, considerations were definitely in favour of the Canadians regarding visits to China for lecturing. The initial identification and situation analysis work of the project team rationalized that this system was not perfect, but in conjunction with the other components, the puzzle pieces would come together at the conclusion of the project's four year term.

3. Component Three includes the transfer of equipment and materials to the two Chinese institutions. Such items as library materials, teaching equipment and some specialized equipment required for applied research were sent over or carried over by commercial transportation carriers or by Canadian lecturers visiting China. (11) This equipment benefitted the Canadians who could then deliver lectures and demonstrate principles and concepts with equipment familiar to them. The equipment on the other hand, benefits the Chinese because they witness the actual use of the equipment and the teaching techniques of the Canadian lecturers. One of the major problems identified by the first Canadian inception mission for the project, was the Chinese students resentment of "feeding the duck" teaching methods which they were subjected to in their traditional style classes. New equipment, teaching techniques and methodology are eagerly observed by students and staff alike. Because of the political and bureaucratic system the Chinese work in, not all of our methods can be used.

   For the most part, the lectures are well received and often repeated more than once to eager students wanting to interact with English speaking people.

4. Component Four includes the management of Canadian inputs by a Canadian Executing Agency and to include a mid-term as well as final project evaluations. (12) This management group has been named The Black Dragon River Consortium. The loosely knit consortium consists of the five aforementioned institutions in Heilongjiang Province, China, in Alberta and Ontario, Canada. Project headquarters are at the International Briefing Centre in the University of Alberta. Regular COSY and NETNORTH usage, facilitates communication daily for project business between management teams at each Canadian institution. Regular meetings within each institution continually monitor the project components and ensures that project management matters, curriculum development, study tours and on campus Chinese students are all being properly managed.

   Several times a year, project management meetings occur at one of the three Canadian institutions. As well, two or three trips per year take Canadian management personnel to China to LHTC, HALRU, or to Beijing for project planning meetings.

## PROGRAM STRATEGY

When the Canadian project identification team went to China in 1983, they not only had to identify the problems which the project would face on a cultural basis, but also the problems of different political and education systems. Since the project was deemed "an educational development project" (13), a model had to be designed to recognize the needs specific to the region wherein the project was to be implemented.

At a national education conference in China, in May of 1985, the "Decision on The Reform of the Education System" was adopted by the Party and State leaders. (14) This, coincidentally, corresponded to the same time period that the BDRC project was in its final planning stages. The door was open for the methodology to be utilized by the project team. Implementation for innovative education was to be whole-heartedly welcomed by the two Chinese institutions who had the all important blessing of the Central Party in Beijing.

"The design of the model recognized our role as more than institutional development. Our task is to assist in the development of the province, regarded as China's bread basket. The challenge is to implement a program of development, defined as a process by which societies change so that they are able to meet the basic needs of their populations, in a way that is sustainable in the long term and which is based largely on indigenous resources and values." (15)

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(11) ibid
(12) ibid
(13) C.I.D.A. - ibid pages 4-13 (HALRU) pages 4-17 (LHTC).
(14) Hayhoe, Ruth. "Education in the People's Republic of China", OISE, February 1986. Ontario Institute for Studies in Education, OISE press, 252 Bloor St. W., Toronto, Ontario.
(15) Stoskopf, Neal C. "Agricultural Education Developments in Northeast China" - by N. C. Stoskopf - Professor of Crop Science and Director of the Associate Diploma in Agriculture Program, University of Guelph, Guelph, Ontario, Canada.

This statement made by Dr. Neal Stoskopf in a recent article, reinforces the concepts which Roland Bunch discusses throughout his book Two Ears of Corn. Although the project is by no means a small project, by Bunch's standards, it utilizes his basic outline which states that a project should 1) achieve early recognizable success, 2) start slowly, start small, 3) limit the technology, 4) use small scale experimentation, 5) and develop a multiplier effect. (16)

## PROJECT ANALYSIS

Making use of the aforementioned principles as described by Bunch, as well as features of the Adoption-Diffusion Theory described by Wayne Lamble and other reference materials, decisions which had to be made for the implementation of this project will be evaluated. It is not known whether or not project leaders were bona-fide trained extensionists in the classical sense of the term. It is noteworthy, however, that the planned evaluation of the region the project was to affect, was very purposeful and orderly. The CIDA document which was written up as a result of the inception mission, and which formally identified the project guidelines, illustrates the clarity and knowledge of the team leaders.

The project, as described in the Project Objectives section of this paper, identified four areas or components: training, technical assistance, transfer of equipment and materials, and project management. Using theoretical reference materials as well as personal observations, the four components will be analyzed.

**Training** - In the training component there arise many questions on how effective can the project be in affecting change at the two institutions LHTC and HALRU. Decisions were definitely made which determined how training was to be implemented. An example of a Collective Decision made was the English training program. Not only did leaders in China feel this was a necessary objective, but the Canadians also felt it was a vital component which could not be omitted. Actually, not much convincing had to be done in this area since Chinese students were eager to learn English and it meant the future training of Chinese in Canada would in fact be possible.

There did develop in the training component a battle of wills between leaders of the Chinese Consortium members and the Canadian members. A one-year certificate program for all Chinese students entering any one of the three Canadian academic institutions was made mandatory. This decision was not arbitrary, but had definite purpose and rationale behind it. In order to be sure that the students sent to Canada were suitably skilled, not only in English but in academic abilities, the one year certificate acted as an adaptation period as well as a trial period for the Chinese participants.

It appears likely that our somewhat paternalistic fear that not all Chinese students would be able to cope and succeed, was a sign of our distrust of the educational background of the Chinese. Since there had been such upheaval as a result of the Cultural Revolution, our fears were not totally unfounded, but except for a few cases, the Chinese students enrolled in our programs seemed very adaptable and extremely capable. It must be noted here that the Chinese age,ranges from 22 to 32 and many, if not all, of the participants in the training program were instructors or assistants to instructors in their home institutions.

The concept of starting slowly and starting small could apply with this training component. A limited number of Chinese from LHTC and HALRU have been assigned to study for one to three year periods in the three Canadian schools. It is hoped, that upon their return, after three years, their fourth year back in China will see them adapting innovations in learning skills from their Canadian experience, into their teaching and research programs in China. The project hopes to achieve some "early recognizable success" before the five years presently contracted for, reaches completion deadlines.

The eleven study tours and four management tours, which have up to this point visited Canada, have been extremely essential in establishing the societal linkage necessary for such a project to succeed. This observation might be somewhat biased as the author of this report is the Guelph Study Tour Coordinator. However, with as much objectivity as possible, the analysis of this segment of training in the project appears to be absolutely essential for successful linkage to occur. With over 65 participants from China having visited Canada from LHTC and HALRU combined, in most areas of agricultural discipline, a strong series of links has been established. These study tour members, in conjunction with 25 Chinese presently studying in Canada, has given exposure to our system to a much larger group of individuals than would be affordable using only the advanced degree courses route which was the other option. Hopefully, a multiplier affect can be achieved using this combined study tour/academic studies format than could otherwise be accomplished.

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(16) Bunch, Roland. Two Ears of Corn, Chapter 17 "The Overall Dynamics" by Roland Bunch, World Neighbors, 5116 North Portland, Oklahoma City, U.S.A. p. 237.

**Technical Assistance** - Component Two, which involves technical expertise, further compliments and builds on the study tours and students training elements. When our Canadian specialists visit China, the topics they are to speak on are decided jointly by Canadian consortium team members with academics in China and Canada. The lecture series are designed to introduce technology and educational teaching techniques at a moderate rate. "High tech" methodology is mentioned, but not advocated in this curriculum development program. Each curriculum development participant from Canada is briefed prior to departure for China. Lectures are intended for faculty rather than students but some general lectures are given to larger groups including students. "Senior Canadian faculty with teaching and research experience are preferred so that presentations can be modified according to the response." (17)

This has proven to be a very wise decision because almost all faculty who arrived with prepared topics were asked to modify or supplement their materials upon arrival in China. These contingent decisions have made for somewhat frustrating, but rewarding experiences for both Chinese and Canadian participants and have proven the need to remain flexible to meet specific needs of the situations as they arise.

**Transfer of Equipment and Materials** - As mentioned earlier "wish lists" were apparent at the outset when the project identification team visited China. Be it paternalistic or logically determined, the Canadian decision was to introduce technology where applicable and in limited and controlled amounts. For example, when one of our agricultural engineering faculty members was asked to be a curriculum development participant, a series of events took place. A briefing took place to familiarize him with the project, the objectives, the site to be visited, the culture to be interacted with and the needs of the institution to be visited. A subsequent study tour from the institution to be visited came to Canada and included administrative faculty from the Chinese institution department of agricultural mechanics. The two weeks in Alberta and two weeks in Ontario saw the Canadian study tour coordinators arranging a diverse program which included on campus seminars, lectures and meetings combined with visits to farms, machinery companies, training, manufacturing and distribution centers relating to agricultural mechanization. Cultural tours to local shopping centers, tourist attractions, dinners in Canadian hosts' homes, etc. were arranged to develop that rapport so essential for freer communication between people from different cultural backgrounds.

Once this study tour was completed and the intended curriculum development individual became familiar with his future hosts in China, a series of lectures and a list of equipment to support his visit was established by the BDRC management team. The component which sends equipment and materials to China then came in to play. Based on all of the information from meetings with project members as well as personal experience, equipment was ordered to guarantee that a viable, basic, functional package of equipment and materials was ordered. The technology was not "high tech" nor was it simplistic in nature. The materials sent over, directly complimented the projects goal to ensure adequate training equipment for use by curriculum development personnel which would be left behind and used as a foundation for further expansion in the Chinese institution. This equipment by no means satisfied the Chinese "wish lists" but neither did it insult their intelligence, because it was equipment they presently did not have but which could be utilized immediately with introductory training by the curriculum development specialist during his visit.

**Project Management** - In analyzing components one through three, it is possible to see the clear and methodical development approach taken by the management team which comprised the fourth component of the BDRC project. In actual fact, one of the biggest problems in the project has been the unwieldy size of the management group. Because of the distance involved between Alberta, Ontario and China, complications can and do occur. Communication, which is the key to any project's success, was initially sometimes poor or non-existent. Not only does culture play a role, but politics and even inter-provincial rivalry at times seems to interfere with the otherwise smooth running project. The decisions to implement the programs are jointly made, the choice of technology to be taught and transferred is easily agreed upon, even the methods of teaching can be reasonably resolved. The problem arises when individual management styles and personality differences begin to surface.

Since the University of Alberta is the principal contracting agent and the University of Guelph and Olds College are invited partners in the project, differences of opinion on who is responsible for what and who controls what, began to become a problem. CIDA, which funds the project, has some say in these matters but by and large they in no way interfered. Communication almost always solves the problem, but in the interim, the large, clumsy beast is sometimes in the position where the left hand doesn't know what the right hand is doing and the head doesn't have complete control of either hands. By the second year of the project, communication links and better methods of information transfer solved many of the initial problem areas and participants began to work better as a team.

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(17) Stoskopf, Neal C. "Agricultural Education Developments in Northeast China" - by N. C. Stoskopf - Professor of Crop Science and Director of the Associate Diploma in Agriculture Program, University of Guelph, Guelph, Ontario, Canada.

## SUMMARIZATION

The problem which faces 1.1 billion people in China is an obvious one of coming to grips with the challenge of ensuring that future generations are cared for. The scope of this project's mandate is minute compared to the problem. However, its objective of assisting in the training of educators who will in turn teach the future generation how to meet the challenge is an important step in the right direction. The following quotation is a profound statement of the challenge which faces members of the Black Dragon River Consortium, as it does any Western culture attempting to work together with Eastasian culture.

"Two fundamental approaches have evolved in the world as cultural norms for adapting to human situations: individualism and collectivism. Individualism is consistent with a set of values and behavioral norms that are the product of a Western world view that has been called "atomistic"; collectivism is consistent with a set of values and behavioral norms that arise within the Eastasian world view that has been called "organistic" or "holistic". Now and then, these two approaches may evolve toward irrational extremes. On one extreme, the result is "rugged individualism", which stresses the need for independence while ignoring or discounting the need for social co-operation to achieve individual fulfillment. On the other extreme, the result is "ragged collectivism", which ignores or discounts the need for individual fulfillment if larger groups are to thrive. One orientation has trouble seeing the forest for the trees, while the other views trees as no more than constituent elements of the all-important forest." (18)

This rather lengthy but perceptive statement identifies where our two cultures are coming from. In order for our supposedly "superior" technology and academic culture to meet with and to work with the Chinese, we must first eliminate our fears and our paternalism. This project seems to be generating interest in Canada and in China because of the amazing rapport the two cultures are developing within the boundaries of the project. We are beginning to realize the complexity of the "Chinese way of doing things", and are hopefully accepting the fact that we don't need to understand all the reasons why things are done as they are in China. As long as we keep in mind the ultimate objective, "that of guaranteeing human dignity to all humanity" the possibility exists that a project such as BDRC can have beneficial affects far beyond the realm of its mandate.

The Black Dragon River Consortium from the limited analysis attempted in this project report, seems to have set an achievable set of objectives. The situational analysis done initially seems to have been appropriately done and the resulting project strategies appear to be functioning well. Only time will tell whether or not the odds were sufficiently calculated and "stacked" in the right direction to enable the desired effects of this project to be achieved. The following is an excerpt from a presentation made by the Deputy Director of the State Farm System to CIDA while he was in Canada in March of 1988 as well as a statement by this author based on observations made throughout the duration of this project. Statements made by Zhang Furu were done so before information on the fate of this project were known by the Canadian and/or Chinese project institutions. None of the participants were aware of a CIDA decision to cancel part of the proposed project extension. The success of the project was well recognized by the Chinese and Canadians, however decisions were made based on rationale (?) seemingly unrelated to the actual project itself. The following statements and quotes are made outside the realm of the previous analysis of the project objectives, and are reactions to the situation that has resulted because of the success of the project and in spite of the successes that have been achieved.

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(18) Walls, Jan W. "Cultural, Economic and Political Dimensions of the Chinese Modernization Effort", Jan W. Walls, Asia Pacific Foundation of Canada, November 1986. p. 5 & 6.

**AUTHOR: ZHANG FURU**
**Deputy Director Heilongjiang State Farm Bureau**
**March 13, 1988**

Ladies and Gentlemen,

The Heilongjiang Agricultural Education Project, under the leadership of the Chinese and Canadian governments, has been progressing very well due to the joint efforts, especially CIDA's effective organization and supervision and the project is actually doing better in many aspects than previously expected. It has had significant influences over the development of both Heilongjiang August-First Land Reclamation University and Liu He Management Training College. Here, on behalf of the General Bureau of State Farms and the two institutions, I would like to express my wholehearted thanks to the Canadian Government, CIDA, Canadian executive body, and all of those who have made contributions to the projects.

Heilongjiang State Farm System is an area with 2 million ha. of cultivated land, 700,000 workers and a total population of 1.7 million people. The agricultural land and the grain production account for 50 per cent that of the National State Farming System. The location of the Heilongjiang State Farm System, which is remote from big cities, attracts very few university graduates. It mainly relies on HALRU and LHTC to provide their graduates to take on those administrative, management, and technical positions and 80 per cent of these positions are filled by those graduates from HALRU and LHTC. CIDA's aid will assist to a great extent the development of the two institutions, which in turn, will contribute substantially to the prosperity of the State Farm System. Therefore, after preliminary studies, CIDA made the decision with long term concerns and chose these two institutions which are in great need, to offer their assistance to. The three years development of the project is a good proof by itself for this decision. The progress of the project is fully in accordance with each annual plan as well as the Memorandum of Understanding signed by the two governments on Dec 28th, 1984.

Since this presentation and report was written, a dramatic policy change has occurred in China as well as in the policies of The Canadian International Development Agency. It appears that politics are again interfering in rural extension policy and development because of the large quantities of money now involved, as well as the political gains which can be made from supporting highly visible foreign assistance programmes. Unfortunately, the Black Dragon River Consortium participants are going to be cut off from this source of Canadian funds as a result of negotiations between the Canadian and Chinese governments. For the first time, a foreign government will apparently be dictating to us how they want our money spent in development programmes in China. As a result the Liu He Cadre Training College will be dropped from the project at the conclusion of the five years. This has come as a great shock to the Chinese in Liu He as well as to the Canadian executing institutions who have seen some dramatic and recognizable improvements since the inception of this project. The comments made by Zhang Furu to CIDA in his presentation appear not to have had any effect in Canada or in China. The powers that be have deemed it politically unworthy to continue supporting the BDRC efforts in North China and lobbying efforts by Chinese and Canadian participants have fallen on deaf ears. Such is the uncertainty of dealing with an agency which seems to be no more than a political tool for our government and for Canadian business interests dealing in foreign trade and assistance packages. No more is left to be said except, "C'est la vie!"

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# Digestive Motility Videotape

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I teach digestive physiology in two third year courses: a DVM course and a BSc course. In each we have used a laboratory project on motility involving an anesthetized rabbit. Although I believe that the learning experience justified the use of the animals in the DVM course, where the students need to learn some basic principles of surgery and anesthesia, I am less comfortable about using live animals in the BSc course. Moreover the DVM students have other laboratory projects in which they use anesthetized animals so that a case can be made for eliminating the use of the live animals in the digestive laboratory provided that the other objectives of the laboratory can be met.

Apart from the general concern about minimizing the use of animals in teaching laboratories there are some specific objections that can be raised about the in vivo motility laboratory. In order to study motility the animal must be maintained at a light level of anesthesia so that there are concerns about the possibility of the animal feeling pain. Furthermore the observations that can be made with the equipment available in the student laboratory are only qualitative. In vitro or test-tube experiments can be carried out that avoid the anesthesia problems and provide quantitative data as well as clearer responses to various manipulations, but these experiments do not provide a picture of the normal patterns of motility in the intact animal.

With this background I started to design a videotape to be used with a test-tube experiment as a replacement for the rabbit experiment. Initially I envisaged a videotape that would simply depict the experiment as carried out by the students. I quickly realized that this approach, although succesfully used by instructors in other laboratories, would not work in this case. For one thing contractions that could be seen with the naked eye could not always be seen on the video screen because of problems with contrast and definition.

A more important consideration is that the laboratory exercises for teaching undergraduates are usually a compromise between the instructional needs and the practical limits to what can be done in the laboratory. In this case, for example, our interest was in the motility of the digestive tract of the dog but we used rabbits in the laboratory for reasons of cost and availability. In many respects the rabbit does not differ greatly from the dog but it seemed likely that we would improve student motivation if we avoided using a model and used the real thing - and of course, by using the dog, we would be able to avoid having to describe the differences between the rabbit and the dog.

Freed from these constraints we returned to the basics: the objectives of the laboratory exercise. The main objective was that the students should be able to describe the patterns of motility of the digestive system and that they understand the control of motility. We decided to make two videotapes dealing with normal motility. The first would cover the events of swallowing, following the food from the mouth to the stomach. The second would deal with gastric and intestinal motility. If possible, we would make a third tape dealing with diseases and abnormal motility. A test-tube or in vitro experiment was introduced so that some direct hands-on experience would be retained. The objectives of the in vitro experiment are to make one aspect of motility more concrete for the students and also to give them some exposure to the difficulties of laboratory study of motility and the extent of the biological variability in the function of the intestine.

In making the videotapes we had access to a valuable resource - videotapes of fluoroscopy of swallowing and of gastric and intestinal motility. These images are obtained by feeding conscious dogs food mixed with barium. X-rays are passed through the animal and detected on a fluorescent screen. Initially I had planned to use these tapes in conjunction with short tapes of the surgical preparation of the rabbit - but as mentioned we found that the definition of the structures on the screen was too poor to be usable. I also had planned to use as supporting graphics some simple pen and ink drawings. In discussion of my needs it was suggest that I consider using computer generated graphics and as a result I met with Doris Burnfield of the Instructional Technology Support Group.

Out of our first meeting came the idea of using animated graphics. This was a tremendous advance because it meant that we could show in diagrams events that could not be captured in the fluoroscopy. It also meant that we could make relationships much more vivid -for instance, arrows connecting structures in our diagrams could be made to flash on and off. In our first tape we have a combination of scenes of a dog feeding, animated graphics of the movement of food through the mouth, fluoroscopy of movement through the esophagus, and one shot of liquid entering the stomach of the anesthetized rabbit. We also have diagrams of the reflex control of swallowing and of peristalsis in the esophagus and its control. For teaching this combination of different types of images seems to me ideal. The feedback I have had from the students indicates that they find the videotape extremely useful.

To sum up: the videotape and modified laboratory in my opinion do a better job of achieving the relevant objectives. At the same time they meet the humane objective of reducing the number of animals used and in the long run will cost less.

I would like to acknowledge the work of Doris Burnfield, the artistic director and Mary Nairn, the computer graphics artist. Dr Paul Pennock provided the fluoroscopy facilities. Financial support was provided by the Office for Educational Practice.

# Computer-Aided Instruction in an Undergraduate Mechanisms Course

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## 1. Introduction

Since 1982, the author has participated in the development of various programs for microcomputers related to mechanism analysis and design, in the Mechanical Engineering Departments at the Universities of Manitoba and Toronto. These programs were specifically designed for tutorial and laboratory use in undergraduate teaching [1-3]. Most of them originated from term projects in an elective course on mechanism synthesis, and from undergraduate theses. Others were developed or enhanced by undergraduate students, hired during summer sessions. In 1987, appropriate programs were integrated into one package. This package, entitled **UTLINK** , is designed for use on IBM PC/XT/AT computers, and is intended to complement lectures in undergraduate mechanisms courses.

Parts of the package were implemented during the past few years in undergraduate tutorials. An overview and discussion is included in the use of these programs in classroom demonstrations.

The package includes:

(i) kinematic and dynamic analysis of four-bar and slider crank mechanisms

(ii) determination of the cognates of four-bar and slider crank mechanisms

(iii) kinematic and dynamic analysis of generalized planar mechanisms

(iv) kinematic analysis of multiple stage planetary gear trains

(v) kinematic analysis of disc cams

(vi) function synthesis of four-bar mechanisms

(vii) rigid body guidance synthesis of four-bar mechanisms.

All programs in the package are user-friendly and menu driven. Users respond to simple questions using the keyboard or mouse. Animations of mechanism motions are employed in most programs. Functional data can be generated in tabular and/or graphical form. Hard copy printouts may be obtained for graphs, tables, and mechanism images. Details of UTLINK capabilities are given in Appendix A. Hardware and software requirements for running UTLINK are listed in Appendix B.

## 2. Implementation of UTLINK in Tutorial Sessions

UTLINK has been installed in the CCIE (Computer Centre for Integrated Engineering) laboratory at the University of Toronto, Faculty of Engineering. This laboratory consists of some 50 IBM PC/XT/AT computers. A timetable was prepared for the undergraduates which would allow each student to spend 90 minutes a week with a computer in the CCIE laboratory.

To date, four assignments using UTLINK have been implemented. For each of these assignments, up to four versions are distributed. However, only one version is assigned to any given student, to reduce the tendency of students copying each other's work.

In general, these assignments are more involved than those given in previous years when UTLINK was not available. Completing the current assignments would not be practicable without the use of a computer.

### 2.1 Assignment #1 - Kinematic Anlysis of a Two-Loop Mechanism

Students are asked to analyze a two-loop mechanism using GNLINK (see Appendix A). They are required to compare results with those obtained from analysis of velocity and acceleration polygons. This assignment helps students acquire an appreciation in the stick diagram representations of mechanisms, and an appreciation of the essential need to use computer algorithms when making multiple analyses of a mechanism.

### 2.2 Assignment #2 - Design of a Multiple Stage Planetary Gear Train

This assignment calls for a two-stage planetary gear train to be designed, using PGTANAL. The arrangement of gears is given for each stage along with the connections of components between stages. Most of the numbers of gear teeth are given. Students must select the numbers of teeth on the remaining gears to generate two prescribed speed ratios by alternately immobilizing two components of the gear train.

Lower and upper limits are specified for the numbers of gear teeth. A percentage tolerance is set on the difference between calculated and prescribed speed ratios.

### 2.3 Assignment #3 - Design of a Disc Cam

Program **CAMPRF** is used by students to design a disc cam. A displacement diagram is prescribed. Students must design a cam so that the maximum absolute value of the pressure angle does not exceed a specified limit. A constraint is also imposed on the overall size of the system.

### 2.4 Assignment #4 - Rigid Body Guidance Synthesis of a Four-Bar Mechanism

Students are required to use **RIGID** to synthesize a four-bar mechanism which will guide a rigid body through three positions. The coordinates and orientations of the rigid body in the three positions are given. Also prescribed are limitations on the area which the motions of all links must not exceed.

## 3. Use of UTLINK for Classroom Demonstrations

Early lectures in the mechanisms course at the University of Toronto introduce graphical algorithms to analyse mechanisms. This instruction is followed by analytical methods, suitable for programming on a computer, forming the basis of some of the algorithms in **UTLINK**.

Demonstrations of **UTLINK** are made during lectures using a projection video system. Using this system, computer graphics images may be readily seen on an enlarged screen, in color, by an entire class. Students are thereby introduced to the programs of **UTLINK**, and shown how to run them. Of particular benefit is the use of graphic animations of mechanisms, which enhance descriptions given by the lecturer.

## 4. Discussion

The UTLINK package has given students an improved understanding of various types of mechanism motions. Feedback from students on the use of the programs has been encouragingly positive.

Use of these programs in teaching mechanism courses complements traditional techniques that have been employed in the past. The author also uses physical models of mechanisms, where the links are made from coloured translucent plastic, which are mounted on a clear plastic base. In this manner, projection of moving parts is possible when placed on an overhead projector [4]. Students are thus able to compare these physical models with the computer graphics demonstrations. They then proceed to investigate the effect of changing the parameters using the computer model.

## 5. Summary

A description on the use of a package of programs entitled **UTLINK** has been presented for teaching mechanism courses to undergraduates. **UTLINK** is now in use and has been distributed to some other Canadian Universities. A copy of **UTLINK** may be obtained by contacting the author. A charge will be incurred, to cover only the costs of materials and handling.


## Acknowledgments

The author thanks the following students from the Universities of Manitoba and Toronto for their valuable contributions to the development of **UTLINK** : C.J. Bartlett, J.J. Dueck, B.J. Glowa, W.E. Glowa, C. Konzelman, D.W. Ohlsen, R.P. Podhorodeski, G.J. Smid, D.R. Strang, A. Sun, W.L. Tse, G. Tyc.

The use of computers in the Computer Centre for Integrated Engineering at the University of Toronto is also gratefully acknowledged.


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## Appendix A Capabilities of UTLINK

### A.1 FOURBAR and SLIDER (analysis of FOUR-BAR and SLIDER crank mechanisms)

**FOURBAR** and **SLIDER** are interactive programs for kinematic and dynamic analysis of four-bar and slider crank mechanisms.

Input data may be entered either interactively or submitted through a text file. For kinematic analysis, users are required to specify all link dimensions and the rotational speed of the input link. For dynamic analysis, users must also provide locations, directions and magnitudes of the applied forces. The mass moments of inertia of the moving links must be given by the user.

Users may generate numerical and/or graphical outputs. Numerical results may be generated for any desired size of increments within the 360 degrees of crank rotation. Outputs for kinematic analysis include angular displacements, velocities and accelerations of the coupler and output links, and the linear displacement, velocity and acceleration components of a specified point attached to the coupler. For dynamic analysis, an option exists to calculate pin forces and input torque. Users may choose to send the outputs to either the screen or printer.

Mechanism animations, with or without accumulated images, may be generated. Alternatively, users may generate the path traced by a coupler point throughout a complete cycle. An option to obtain a hard copy of the mechanism images is available. A typical mechanism and some of its corresponding function graphs are given in Figure A.1.

### A.2 GNLINK and FAME (kinematic and dynamic (Force) Analysis of GeNeralized planar LINKages)

**GNLINK** is an interactive program for the kinematic analysis of multiple loop, multiple input, planar mechanisms. Output options include mechanism animations, and trace paths of a specified point on any link, and kinematic function graphs. Graphical and tabular outputs for several functions are also available.

Kinematic models are interactively input as a sequence of vectors which form vector loops. Users must supply the input variable(s), dependent variables, and the vectors which are common between vector sequences. The four-bar driven piston in Figure A.2(a) is an example of a multiple (two) loop mechanism.

Its corresponding vector representation is given in Figure A.2(b), and a summary table corresponding to this model is shown in Figure A.2(c).

The iteration procedure in this program adjusts the dependent variables to form closed vector loops. The user must specify a tolerance value to obtain the level of accuracy desired.

An option is available to portray the mechanism in a single configuration, and trace paths of selected points throughout a cycle. The user may select any combination of vector heads and tails for trace plotting. A trace path plot for the four-bar driven piston example is illustrated as Figure A.2(d).

An example of a function graph is given in Figure A.2(e) for a four-bar driven piston. The horizontal and vertical axes are scaled in fractions of the maximum absolute values listed.

A tabular output of the kinematic results can be generated. Values of displacement, velocity and acceleration for all dependent and input variables are listed.

**FAME** is an interactive program for dynamic force analysis of planar mechanisms. Program output capabilities include tabular and/or graphical outputs of reaction forces, and applied forces, applied torque on any specified nodes and links. It employs calculations stored in data files from **GNLINK** .

From the vector representation of a mechanism, the program automatically numbers all nodes and links. Most of the user interface is menu-driven and makes extensive use of function and cursor keys. The user must supply the externally applied forces, masses, centroids and mass moments of inertia for the links. Externally applied forces or torques to the mechanism are interactively specified using graphical displays of individual links.

The user has the option to store the results obtained from either **GNLINK** or **FAME** in a data file.

### A.3 FCOGNATE and SCOGNATE (COGNATEs of Four-bar and Slider crank mechanisms)

**FCOGNATE SCOGNATE** are interactive programs for creating cognates of four-bar and slider crank mechanisms. Output options include tabular output of link lengths for the cognates, graphical output of primary linkage, Cayley's triangle, cognates, and a trace path of the coupler point.

Input is required at the beginning of the program to specify all parameters for the mechanism. Users may display the mechanism at any desired input angle. A typical four-bar mechanism and its two cognates is shown in Figure A.3.

### A.4 PGTANAL (kinematic Planetary Gear Train ANALysis)

**PGTANAL** is an interactive program for kinematic analysis of multi-stage planetary gear trains. Output options include the absolute and relative rotational speeds of each gear, in every stage. The speed ratio of the gear train is output by the program.

Gear trains are formed from Lévai's twelve types of planetary gear trains. The user is required to specify the numbers of gear teeth, connections of components between stages, and rotational speeds of the input components. The planetary gear train in Figure A.4(a) is an example of a two stage gear train, with stage 1 being type A and stage 2 being type B.

Input is required at the beginning of the program to specify the total number of stages in the planetary gear train and the gear types corresponding to each stage. The user is required to enter the number of teeth for all gears. Typical graphical displays obtained using this program for the gear train shown in Figure A.4(a) are shown in Figures A.4(b) and A.4(c).

The user must specify which links (gears or cranks) are the input and output of the gear train. Constraints are specified by matching the speeds of components between stages. Figure A.4(d) illustrates typical outputs obtained from this program, for the gear train shown in Figure A.4(a).

### A.5 CAMPRF (CAM PRoFile)

**CAMPRF** is an interactive program for the kinematic analysis of plate (disc) cams. Output options include tabular and/or graphical kinematic output of follower displacement, velocity, acceleration, jerk and pressure angle. A display of the mechanism profile (cam contour) is also available.

The shapes of followers include knife edge, flat face, and roller face. Follower motions may be either pivoting or translating with an offset. Displacement motions of followers include dwell, constant velocity, constant acceleration (parabolic), simple harmonic, cycloidal and modified trapezoidal.

The user is required to specify pertinent dimensions of the cam and follower, including the base circle diameter, offset, and for roller followers, the follower diameter. The user must select the cam rotational speed.

The displacement of the follower is specified by breaking the motions of the follower into the desired number of intervals. For each interval, the range of rotation angles and the corresponding type of motion is specified. Besides the dwell, the user is required to specify the rise and fall displacement of the follower. A tabulated input summary is automatically provided after having input all parameters. Figure A.5(b) illustrates a tabular summary corresponding to the cam and follower shown in Figure A.5(a).

The user may choose to see output results either numerically or graphically. Graphical outputs

include function graphs of kinematic parameters, and a display of the cam profile at any desired degree of rotation. For the cam contour, the user has an option to include the follower in the display. Also, two cam contours from different data files may be superimposed.

### A.6 FUNCSYN (FUNCtion SYNthesis of four-bar mechanisms)

**FUNCSYN** is an interactive program for function synthesis of four-bar mechanisms. Output options include tabular outputs of synthesized link lengths, kinematic relationships and structural errors; and, graphical outputs of the actual and synthesized function plots, and a structural error plot. A typical set of graphs for a synthesized mechanism is shown in Figure A.6.

Types of functions that are available for mechanism synthesis include exponential, sine, natural logarithm, common logarithm, and $y = x^i$ . The user is required to input the angle ranges for the input and output motions. The user-specified set of angular locations relating input and output motions may also be given. The program will indicate when a synthesis is impossible.

Tabulated results may be output showing actual and synthesized function values, and the differences between these values.

### A.7 RIGID (RIGID body motion synthesis)

**RIGID** is an interactive program for synthesis of a four-bar mechanism for guidance of a rigid body through three positions. Output options include tabular output of all link lengths and angles for the three positions, and the pivot point coordinates, and clockwise or counterclockwise animation through the designated positions, with or without accumulation of mechanism images.

The user has the option to select one of the following means of specifying the information:

(i) three positions of the coupler end locations

(ii) coupler end locations for the first position (and capability to guide a rigid line segment through three positions)

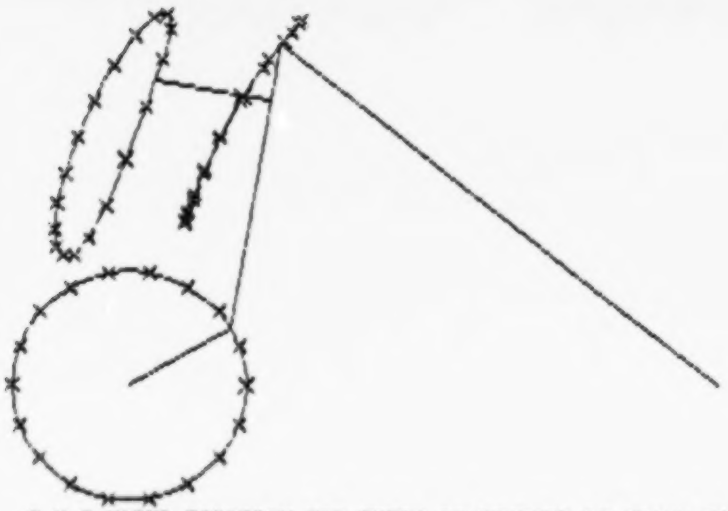
(iii) three positions and the two base link pivot points.

Data are input using either the keyboard or mouse.

Figure A.7(a) shows a typical tabular summary of a synthesized mechanism. Figure A.7(b) illustrates three outlines of the mechanism corresponding to the three desired positions of rigid body guidance.

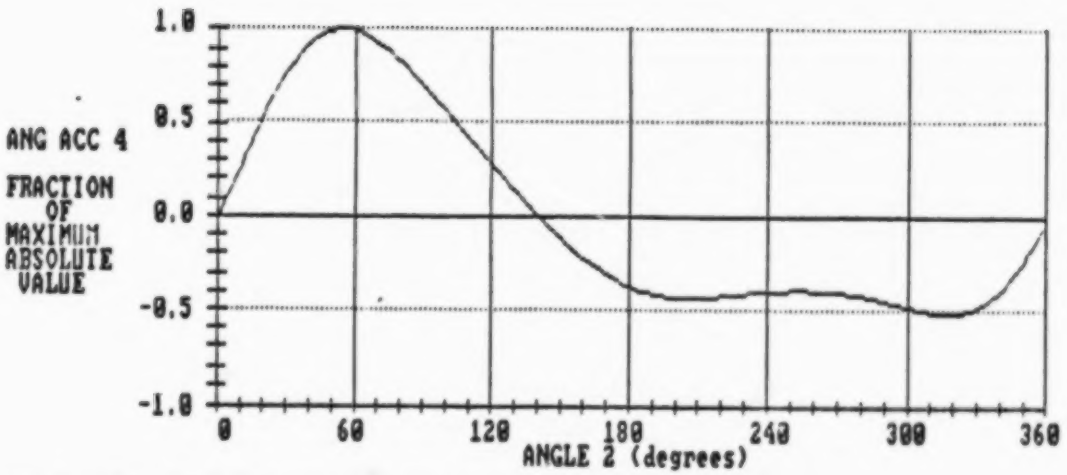
## Appendix B Hardware and Software Requirements of UTLINK

| | |
|---|---|
| Hardware Configuration: | IBM PC/XT/AT, or compatible |
| | CGA or EGA color monitor |
| | Epson MX-80 or MX100, or compatible |
| | mouse (optional) |
| Memory: | 640K minimum |
| Operating System: | DOS |



" X " MARKS POSITION FOR EVERY 20 DEGREES OF CRANK ROTATION

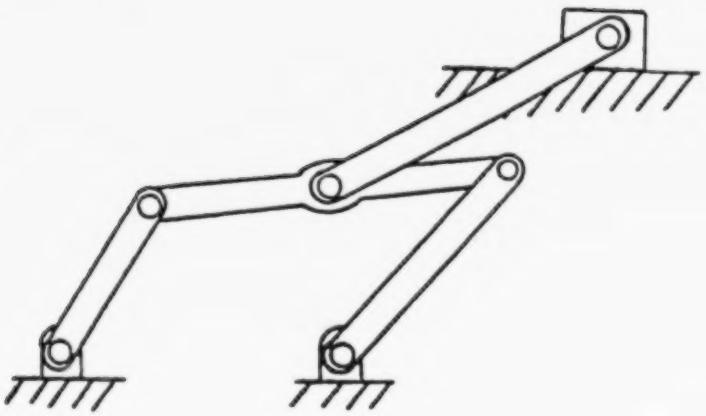
(a) Mechanism



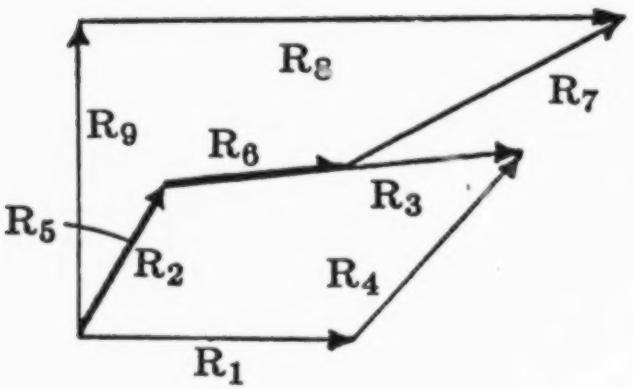

THE MAXIMUM ABSOLUTE VALUE OF ANG ACC 4 IS .140194E+03 rad/s**2
AND THE CORRESPONDING ANGLE 2 IS 54.0 DEGREES

(b) Function Graph

Figure A.1 Four-Bar Mechanism



(a) Mechanism




(b) Vector Representation

Figure A.2 Two Loop Mechanism (page 1 of 3 pages)

**********

MECHANISM MODEL-

INITIAL VECTOR INFORMATION

| VECTOR NO. | LENGTH | ANGLE |
|---|---|---|
| 1 | 3.0000E+00 | 0.0000E+00 |
| 2 | 1.0000E+00 | 4.5000E+01 |
| 3 | 3.0000E+00 | 2.0000E+01 |
| 4 | 2.0000E+00 | 7.5000E+01 |
| 5 | 1.0000E+00 | 4.5000E+01 |
| 6 | 1.5000E+00 | 2.0000E+01 |
| 7 | 3.0000E+00 | 6.0000E+01 |
| 8 | 2.0000E+00 | 0.0000E+00 |
| 9 | 2.2500E+00 | 9.0000E+01 |

DEPENDENT VARIABLES

| DEPENDENT VARIABLE NO. | VECTOR NO. | A or L |
|---|---|---|
| 1 | 3 | A |
| 2 | 4 | A |
| 3 | 7 | A |
| 4 | 8 | L |

COMMON VARIABLE PAIRS

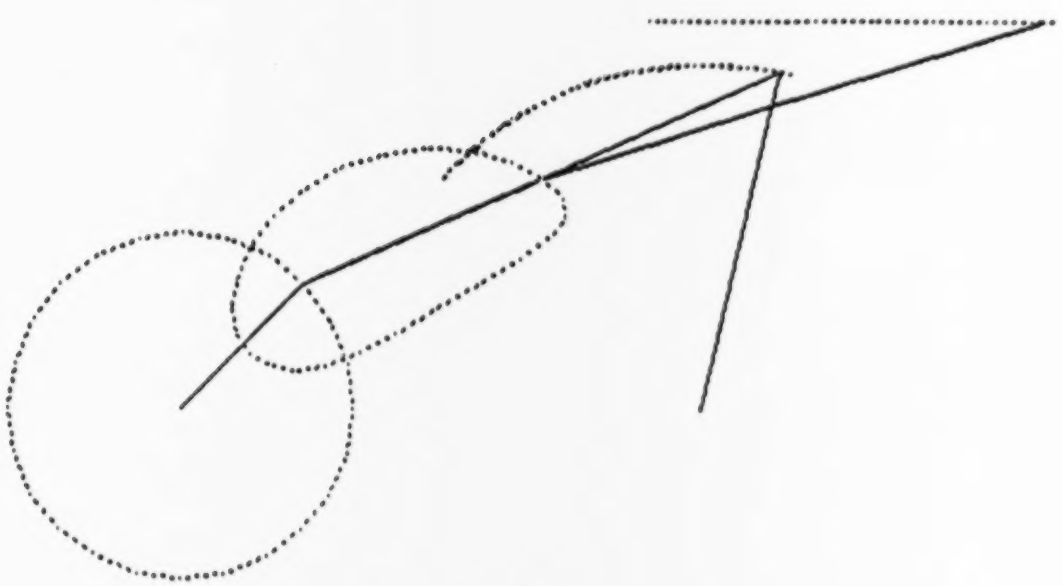
| PAIR NO. | PRIMARY | SECONDARY | A or L | DIFFERENCE |
|---|---|---|---|---|
| 1 | 2 | 5 | A | 0.0000E+00 |
| 2 | 3 | 6 | A | 0.0000E+00 |

LOOP SEQUENCES

| LOOP NO. | SEQUENCE |
|---|---|
| 1 | 2 3 -4 -1 |
| 2 | 5 6 7 -8 -9 |

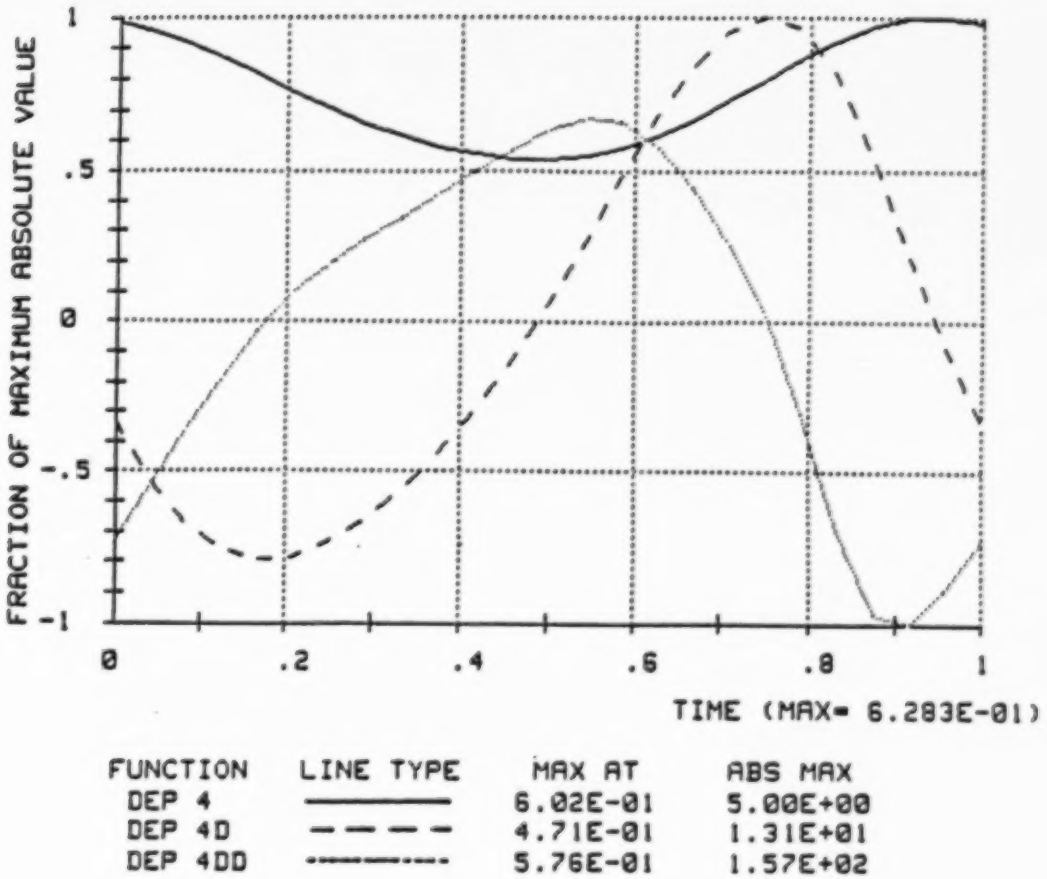
**********

**(c) Vector Model Summary Table**



**(d) Trace Path Plot**

**Figure A.2 Two Loop Mechanism (page 2 of 3 pages)**




| FUNCTION | LINE TYPE | MAX AT | ABS MAX |
|---|---|---|---|
| DEP 4 | ——— | 6.02E-01 | 5.00E+00 |
| DEP 4D | — — — — | 4.71E-01 | 1.31E+01 |
| DEP 4DD | ·———·——· | 5.76E-01 | 1.57E+02 |

(e) Typical Function Graph

**Figure A.2 Two Loop Mechanism (page 3 of 3 pages)**

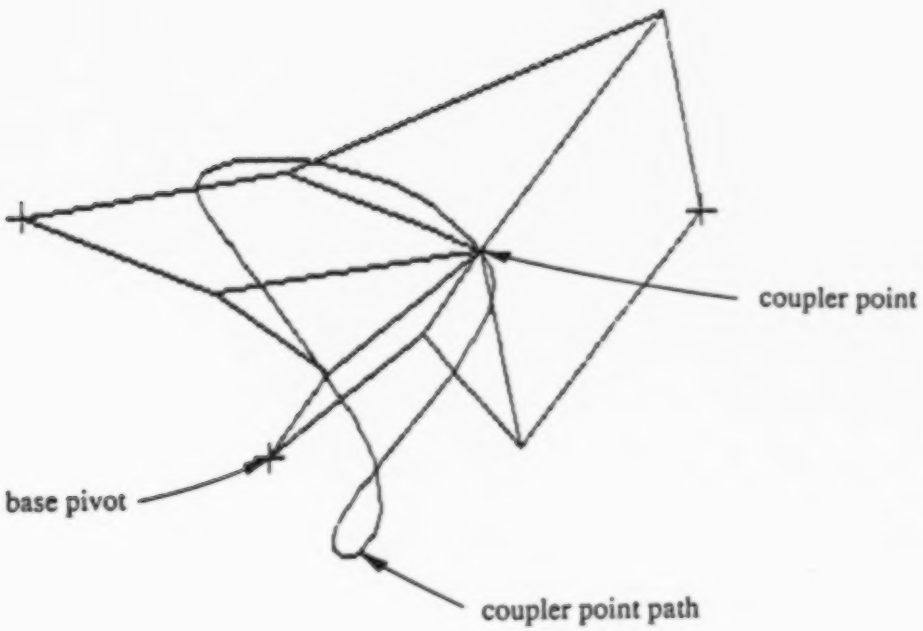
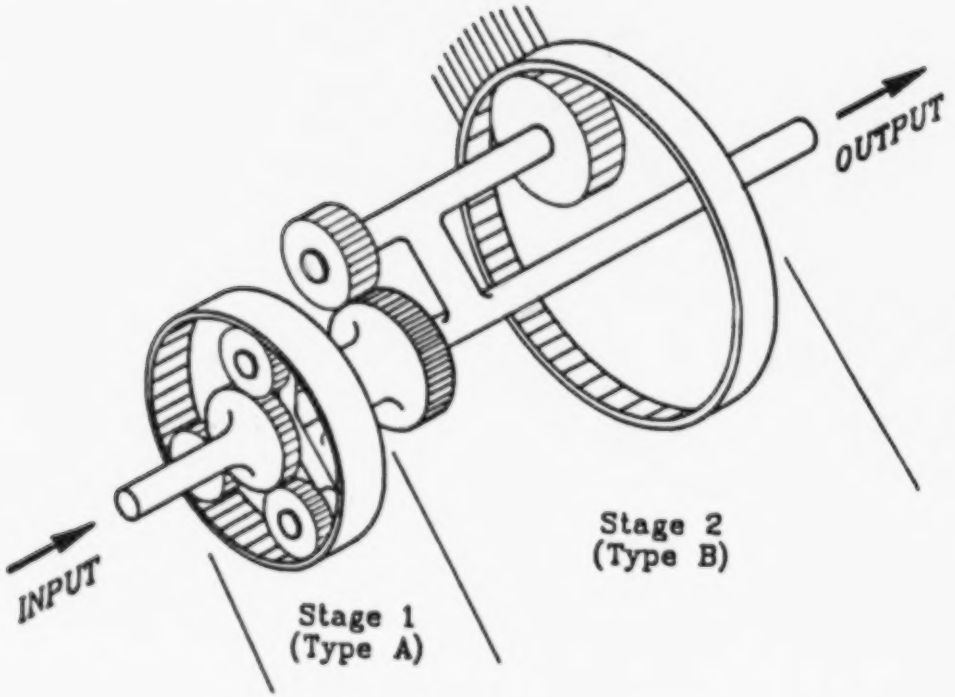



**Figure A.3 Cognates of a Four-Bar Mechanism**

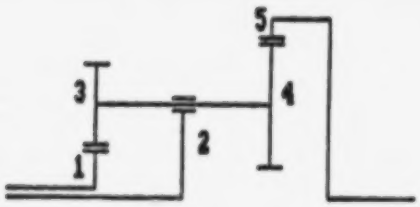



(a) Gear Train

Figure A.4 Two Stage Planetary Gear Train (page 1 of 2 pages)

```
ENTER THE TOOTH NUMBERS OF EACH GEAR FOR :
          GEAR TYPE : a
PLANETARY STAGE : 1

N1 = 20
N3 = 25
N4 = 75
```

(b) Stage 1 Parameters



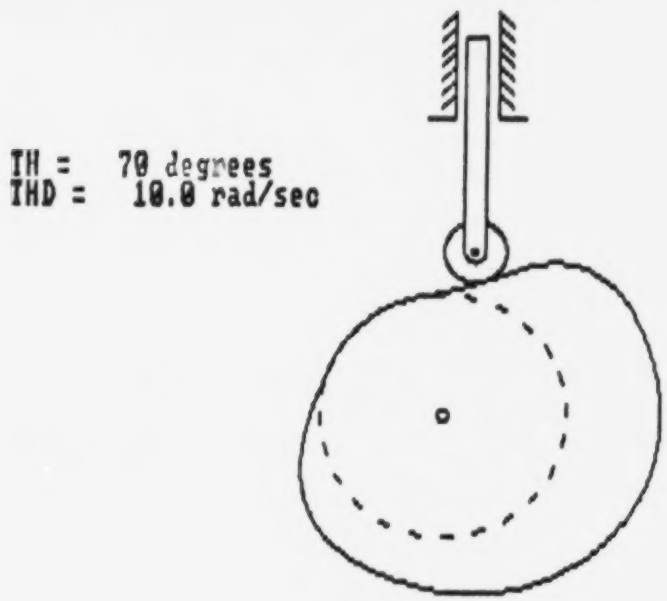

```
ENTER THE TOOTH NUMBERS OF EACH GEAR FOR :
          GEAR TYPE : b
PLANETARY STAGE : 2

N1 = 15
N3 = 15
N4 = 35
N5 = 80
```

(c) Stage 2 Parameters

```
                    RESULTS
                    =======


          INPUT  = COMPONENT 1 OF STAGE 1
          OUTPUT = COMPONENT 2 OF STAGE 2

          INPUT ROTATIONAL SPEED  =     .20000E+03
          OUTPUT ROTATIONAL SPEED =    -.28571E+02

          SPEED RATIO =    -.14286E+00


                ROTATIONAL SPEEDS
                -----------------

STAGE 1     PLANETARY GEAR TYPE (a)

COMPONENT |   ABSOLUTE    |   RELATIVE
          |    VALUES     |    VALUES
----------|---------------|--------------
          |               |
     1    |   200.000     |   200.000
          |               |
     2    |   -28.571     |   -28.571
          |               |
     3    |  -211.429     |  -182.857
          |               |
     4    |   -93.878     |   -93.878
          |               |
----------|---------------|--------------
```

(d) Typical Output Results

**Figure A.4 Two Stage Planetary Gear Train (page 2 of 2 pages)**




(a) Mechanism

SUMMARY OF INPUT GEOMETRY

TYPE OF FOLLOWER : TRANSLATING, ROLLER

BASE DIAMETER, Bd = 4.00

OFFSET, S = .50

ROLLER DIAMETER, Rd = 1.00

CAM ROTATIONAL SPEED (rad/sec, + for ccw, - for cw) = 10.00

SPECIFIED FOLLOWER MOTION

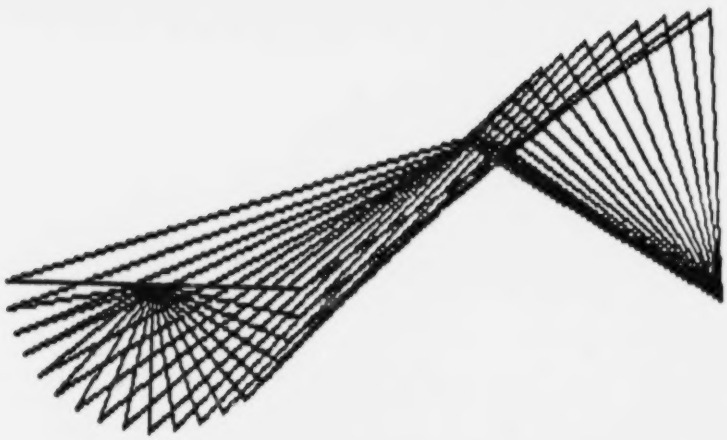
| INTERVAL NUMBER | INITIAL ANGLE FOR INTERVAL (degrees) | FINAL ANGLE FOR INTERVAL (degrees) | TYPE OF MOTION | RISE (+) or FALL (-) |
|---|---|---|---|---|
| 1 | 0 | 50 | Dwell | .000E+00 |
| 2 | 50 | 120 | Const. Acc. | .150E+01 |
| 3 | 120 | 160 | Dwell | .000E+00 |
| 4 | 160 | 270 | Simple Harmonic | -.700E+00 |
| 5 | 270 | 360 | Cycloidal | -.800E+00 |

(b) Input Summary Table

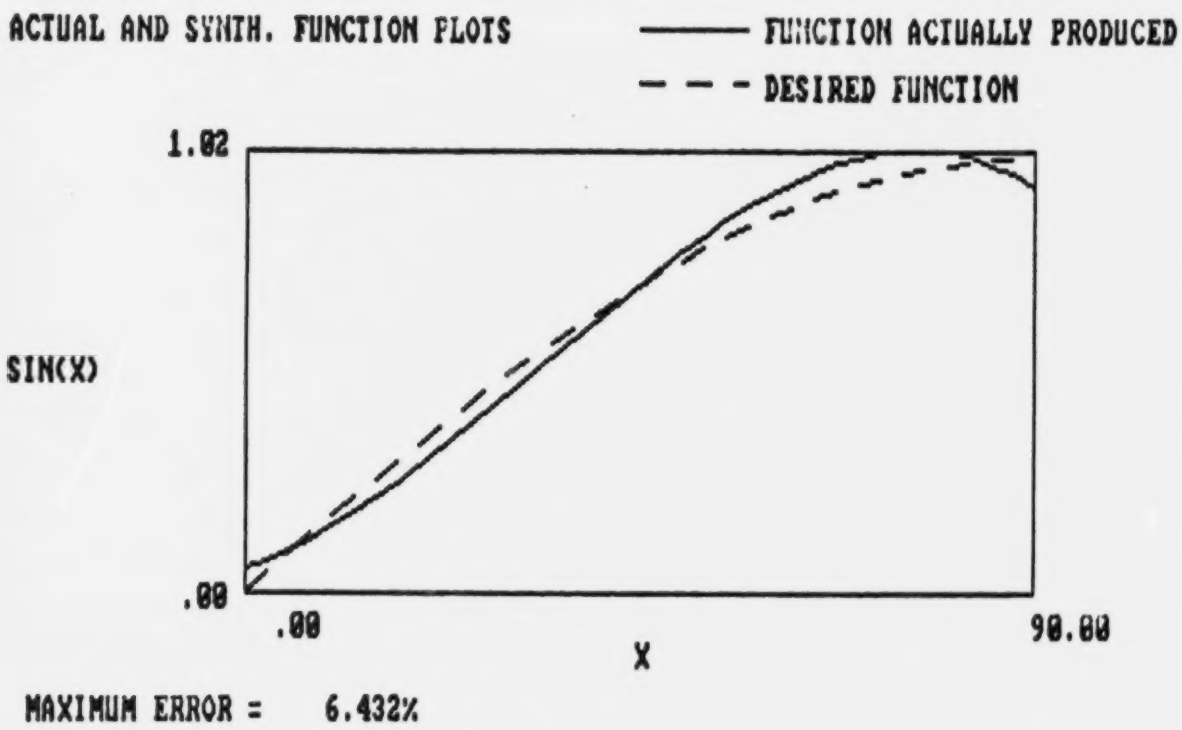
**Figure A.5 Disc Cam**



56

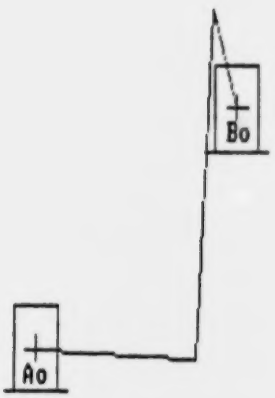


(a) Mechanism




(b) Function Graphs

Figure A.6 Function Generating Mechanism




**(a) Mechanism**

RIGID MOTION RESULTS: A:temp1.RGB ROCKER-ROCKER

LINK LENGTHS:

| | | | |
|---|---|---|---|
| Base Link, AoBo | 2.649 | Link 2, AoA | 1.312 |
| Coupler Link, AB | 3.015 | Link 4, BoB | .862 |

PIVOT COORD S: AoX: 3.250 AoY: -1.007 BoX: 5.163 BoY: 1.071

LINK ANGLES (degrees):

For 4-BAR Links (measured from horizontal):

| | | | | |
|---|---|---|---|---|
| POSITION 1: | LINK 2, AoA | 116.557 | LINK 4, BoB | 74.036 |
| POSITION 2: | LINK 2, AoA | 205.225 | LINK 4, BoB | 215.983 |
| POSITION 3: | LINK 2, AoA | 297.875 | LINK 4, BoB | 309.269 |

**(b) Summary Table**

**Figure A.7 Rigid Body Guidance Mechanism**

# Competencies for the Educational Developer

**Robert D. Cook**
Sheridan College

The technology to design and deliver effective computer-based instruction in education, business and industrial training environments is becoming more widely available. But good quality software is still too rare a commodity to allow this medium to achieve its potential for providing solutions to educational problems.

The major reason is that there are too few skilled educational software developers.

In this paper I would like to suggest some developer competencies which can contribute to the production of more effective instructional software. My observations will be based upon the experiences of the Courseware Design & Production Program at Sheridan College, Canada, and the successes of its graduates.

First, however, it is important to acknowledge the contribution of those who have been producing materials in this still very new learning technology. The successes and failures of the past.

Let us consider, then, directions for the professional development of ourselves and our colleagues, objectives for courses we may teach to prospective developers, and skills to look for in those we hire.

## CURRENT DEVELOPERS

Who has been developing computer-based instruction so far?

Current developers come from a wide range of disciplines, each bringing many strengths and weaknesses to development work.

Many are computer specialists--programmers and analysts. Their materials are coded economically and usually give good demonstration to the "bells and whistles" of hardware. But with no foundation in Instructional Design methodology, the computerist's programs are often weak in content and pedagogy.

The content expert in business or industry, reassigned to the training division from the shop floor, usually gets the content right and knows the learners well. But she, too, often produces materials with educational flaws. The difficulties inevitable as she changes roles from doer to teacher are exacerbated when the new task is not just to teach, but to teach with a computer. Some hardware, an authoring system, and perhaps a bit of poorly written documentation are inadequate resources to allow the subject matter expert to generate good courseware.

Experienced teachers or trainers, proficient in traditional delivery methods, often know best what experiences students need, have excellent ideas for courseware, and may know how to integrate computer-based materials into a learning system. However, they may not have the complete range of instructional design skills required to bring an overall design to completion. And the hackers among them may encounter insurmountable execution problems owing to the size and complexity of interactive lessonware.

Skilled instructional designers, in business or education, transfer to CBI design a wide range of essential skills. But without experiences focussed on CBI, they lack sufficient knowledge of the medium's special capabilities and how to use them. Unfamiliar with resources already available, they may reinvent the wheel. And if required to execute their own designs, they commonly underdesign the materials, anticipating the limitations of their programming skills.

Some linear television producers have made the leap to interactive video production with tape and laserdisc. Their work can show lack of experience with a medium allowing more complex user/material interactions. And concepts of continuity take on totally different meanings in an environment where variety of visual and audio juxtapositions are not only possible but desirable. The task is not simply to drive a linear videotape by a computer, but to develop an interactive package from the ground up.

A review of the strengths and weaknesses of each of these, and other, developers, including computer graphic artists and audio technologists, confirms that while none has the full complement of skills required to produce top quality computer-based instructional materials, each has a specific perspective or skill which could contribute to a successful package.

Should not the model courseware developer, then, be someone who by extensive study and experience has developed the expertise of each of these developers? Perhaps, but one is unlikely to find many of that breed.

## TEAM APPROACH

The alternative, of course, is to assemble a team of experts each with her own specialty. A skilled project manager would assign tasks, maintain communication links, provide dispute arbitration services, and generally co-ordinate the project to a successful close. This is a highly desirable, and effective model, and has resulted in some of the most effective computer-based materials produced.

It is also an expensive, time consuming, and often totally unavailable option as when the budget can simply fund only one developer. And the model lacks any one individual who can communicate with each team member if not as an equal, at least as someone who has an intimate understanding and appreciation of the expert's special craft.

## COURSEWARE DESIGN GENERALIST

Here, then is the role for the courseware design generalist - the "Renaissance Man or Woman" of computer-based instruction: able to converse with specialists in the specialist's jargon; able to appreciate and encourage their potential contribution, listen sympathetically to their problems, and be wary of their hyperbole; and in the absence of one, several or all specialists from the team's composition, able to judge when to cancel a project or when to substitute her lesser, but adequate skills in order to bring the task to a reasonable, quality completion. Simply put, the courseware design generalists knows what is possible, and when to get help.

The most effective generalists are likely to come from the classes of developers or potential developers named above. Working from a base of valuable expertise, the task before them is to expand their competencies.

## SKILLS INVENTORY

What specific skills should the developer generalist acquire?

She should be skilled in instructional design, able to take a systems approach to the development of instruction regardless of subject matter. Particularly important skills would include the specification of objectives, audience analysis, choice of instructional strategies, and performance evaluation. Design decisions should be informed by an understanding of developmental and educational psychology principles.

A good educational software developer should accept that the first question to be considered is whether to use CBI at all. She should know when and how to use CBI and when not. Familiarity with the full range of other instructional media, an understanding of their greater effectiveness with different learners, content and learning environments will lead to the development of better, but not necessarily computer-based, learning materials. She should understand the options of creating stand-alone computer materials, or those which anticipate extensive wrap-around materials or activities.

For the instances when CBI development is agreed upon, the developer should have familiarity with existing computer-based learning materials, so as to avoid duplication of efforts, as well as to benefit from the successes and failures of our colleagues. The possibilities for synthesis of new learning solutions are greater when one's base of experience is wide.

The educational software developer should enjoy general computer literacy. She should be able to converse with computer specialists; cross-pollinate her designs from a knowledge of computer applications in other disciplines; be alert to social issues which should most likely be addressed in her designs, for example: invasion of privacy; the isolation of computer users; economic factors in computer accessibility; women and technology. She should know the resources available to improve both the development and delivery of instruction; the variety of hardware, software, and non-computer-based materials.

The developer generalist should have a knowledge of two-dimensional visual design as applied to the layout of text screens, computer graphics and computer animation, as well as knowledge of how visuals are used in education - what's most effective and when.

One of the most difficult, she should be developing an understanding of the nature and possibilities of meaningful interaction in computer-based instructional materials - the difference between what Dr. Larry Brink (1985) calls "hands-on" and "minds-on" learner activity.

She should have developed at least introductory, transferable skills in design execution, including storyboarding, flowcharting or its alternatives, coding, and debugging. If she is to be able to communicate with specialists, a good developer must have had the experience of taking her paper-based design step-by-step through the complexities of getting it to the screen. Was T.S. Eliot (1963) thinking of CBI development when he note : "Between the idea/ And the reality/ ... Between the conception/ And the creation/ ... Falls the Shadow"?

The designer generalist should have a knowledge of various execution alternatives, the advantages, and disadvantages in given circumstances of general programming languages, authoring languages and authoring systems.

She should be skilled in formative evaluation, in order to test a product in development.

She should have documentation skills to prepare comprehensive instructor, student and system installation guides.

If she is to work with interactive video, she must acquire familiarity with the technology of linear video production. She must augment it with an understanding of the new potentials interactivity affords educational television, and the differences it suggests to conventional concepts of continuity.

She must develop a range of problem-solving, consulting, and change-agency skills. Skills in proposal writing and project management techniques would clearly be beneficial.

And above all, the computer-based instructional designer must be able to apply all of these competencies in a real environment, confronted by deadlines, budget limitations and, most importantly, real learners.

## IS IT POSSIBLE?

The expectation that one person could within a reasonable time develop all of these competencies may appear unreasonable. But remember, the task is not to develop expertise in each of these areas, but to have sufficient experience and knowledge to converse meaningfully with experts, and to substitute one's lesser skills when there is no alternative.

Five years operation of the Courseware Design & Production Program at Sheridan College has shown us that the efforts of individuals to develop such a wide range of competencies are both possible and useful.

Our students have included educators from pre-school through post-secondary, business and industrial trainers, computer programmers, technical writers, media producers, a bush pilot, and a lawyer. They have followed either a nine month fulltime program, or enrolled for summer or part-time evening and day study.

Employers concur that our graduates[' range of skills is desirable. Over ninety percent of graduates are working in their chosen field. Many have assignments in the recommendation or development of computer-based materials at levels from pre-school through post-secondary education. Others do analagous tasks in corporate training environments. Still others provide contract services in documentation, the design and scripting of interactive video materials, or the independent formative evaluation of materials under development. Two graduates have worked in marketing, one in educational software and the other in authoring systems.

No two are doing the same work. Some have specialized in a single field; but through the breadth of their study experiences, they are better equipped to understand their role on a CBI development team. Others are practicing generalists, either team managers or lone workers in environments which cannot support more expensive alternatives. Many of these are introducing new groups of learners to the advantages of computer-based learning.

In this paper I have outlined the developer competencies which our experience at Sheridan College has suggested can enhance the prospects for better computer-based learning materials.

Clearly any list of competencies must be dynamic and ever changing. I look forward to hearing your ideas on the directions we should be taking to improve the potential experiences of future computer-based learners.

Brink, Larry. "What's so special about CBT? - Making the most of the medium". Data Training, March 1986.

Eliot, T.S. "The Hollow Men". Collected Poems 1909-1962. London: Faber & Faber, 1963.

* *Earlier versions of this paper were presented to the International Conference on Courseware Design & Evaluation, Ramat Gan, Israel, April 1986; and the Annual Conference of the Association for Media & Technology in Education in Canada, June 1987.*

# Studying the Dictionary

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Lakehead University

It is now almost axiomatic to state that a large number of first year university students have major difficulties with writing. It is also common knowledge that many of the students, if at all familiar with the dictionary, know it only in an abridged or concise form.

Though the old British system of learning language skills in English through conjugating verbs is outdated, the type of mental discipline it taught is not. A modern preoccupation only with newness has severed our contact with educators like the Roman Quintilian. It was from his writings that some Renaissance writers derived the conviction that all study, and especially that of mathematics, should be made to seem like play. Euclid had first popularized the study of geometry by making it a kind of game.

Instructional "Show & Tell" which aims at "a sharing of innovation," seems to have some of its roots in a venerable tradition. But, just as importantly, it affirms the need to make this game-like, cooperative effort appropriate to technological society.

## 1. Aim of Assignment

This assignment called "Studying the Dictionary" aims at doing several things:

A. It requires students to consult the dictionary, to spend some time playing with words and hence ideas, and to share that experience with someone else.

B. It demands that students attempt a project that calls for the management of time and the expression of their imagination and creativity.

C. It rewards all students in several practical ways: through a grade; with exposure to a different way of learning; and with an individualized assessment of personal growth in the learning process.

D. It rewards the instructor with tangible proof of the effectiveness of the method while also revealing student attitude to the experience. Equally important is the feedback on how worthwhile was the experiment. A special bonus is its accomplishing of the unexpected by appealing to that within the individual psyche that wants to grow.

## II. Approach Used in Assignment

The Assignment also makes use of a variation of the "Case Study Approach."

Guided by personal interest or discipline enrolled in, students choose the particular case they want to research. They consult at least one unabridged dictionary. Many students consult other dictionaries and encyclopedias.

They choose 1 letter of the alphabet, and locate 20 words that they find interesting. They find the meanings of these words and write sentences using ;the words. Of the 20 words they locate, they choose one and pursue its history.

In effect, the study of the history of this word involves a bit of detective work as well as the analysis, in some degree, of how a particular word came into being. The study also reveals to students that words are live things. That words have a kind of parentage and belong to a family. That words can also become outdated and worn out.

And so in studying the particular case history of a word, Students may study themselves. (See Letter on History of word Heather). Or, it may provide the more imaginative student with the opportunity to indulge his fancy. (See Copy of Interview.).

## III. Formal Presentation through Role Playing

The third part of this assignment involves the writing up o an exercise making use of the facts students have unearthed. This material has to be formally written up.
Students are asked to write a short exercise of about 1 type-written page. To keep the element of "fun" alive, role-playing is introduced here. This is considered important in an assignment designed to be completed over several blocks of time. Students could approach the written part of the exercise from one of four different perspectives. They could write as the author of:

1) a letter
2) a proposal
3) an article

or

4) an interview

The element of choice is an essential part of both phases II and III of the assignment. An assignment like this caters both to the interests and needs of a variety of students.

The students who have worked on this assignment majored in a variety of disciplines and areas:

| | | | |
|---|---|---|---|
| Computer Science | Psychology | Biology | General Program |
| Nursing | Library Tech. | Chemistry | |
| Geography | Social Work | Mathematics | |

In addition, these students varied in ages--from mature adults in their early fifties to young adults in their late teen years--and hence in their living experiences. Then, too, there were several students whose first language was not English. And even among those whose native tongue was English, and who said that they had written several essays during their last years at High School, there were few shining stars.

## IV. Proof of Student Approach

The final task in this assignment involves the submission of evidence by students that they have handled the exercise themselves. They were told during the second week of classes when the assignment was given that they should keep a file. Here they detailed and documented their handling of the assignment.

This assignment helped to demonstrate to students the necessity of handling the demands of one course to fit in with those of other courses. It also reinforced a central point discussed as part of the writing process--a final paper is rarely a first attempt.

The file that was submitted as part of the assignment provided a journal type record of:

a - time spent and periods allocated for work on the project

b - draft(s) written of formal presentation as in III

The information provided through this file is also useful in other ways. It could indicate whether the project was too complex; how it could be improved or perhaps streamlined; and whether the mark allocated to this task was in just proportion to the work done by students.

In addition, the absence of the file as a component of the assignment, was itself an index of many things. For example, students' ability to organize their time, or follow directions. It also made it possible to identify the specific stage at which a problem arose, and possibly provide the opportunity for the student who is willing but weak to work again at a specific task.

## History of the word Heather

by Heather Manty

The word "heather" which has also been known as "hathir", "hadder" and "hedder" originated in northern Scotland. The first appearance of the word was in the 1300's and was spelled 'hathir". It is not known for sure exactly when today's spelling of "heather" came into being, but it is believed to have been sometime during the 18th century. Although experts are not positive, it is quite likely that the present literacy form is derived from the word "heath".

The word heath refers to a type of plant or shrubbery, including erica and ling, which when looked up in the dictionary are described as heather. Heath is also defined as open, cultivated ground clothed with shrubby plants known as heath or heather.

In Scotland. heather is a very versatile plant. Its beautiful flowers are commonly used for decorative bouquets. The roots of the heather plant are used to make smoker's pipes called briar pipes. Heather is also used to describe a type of fabric with mixed or speckled hues, thought to resemble heather.

There are various phrases used in Scotland which include the word heather. The most common of these phrases is "to set the heather on fire". This means to cause a disturbance or create confusion. Another common phrase is "to take to heather" which means to become a bandit. The latter phrase gained popularity years ago when bandits hid under the heather bushes to escape from the police.

In doing this study, I found that heather has a unique and interesting history. There is, however, one more use of the word which I have not yet mentioned. Heather is also a nice name for a girl, and because it is my name I found this exercise quite intriguing.

# INTERVIEW

by Kevin Viklen

**Narrator:** Welcome to another edition of "Words Worth", the weekly interview series which each week examines a certain word and its history. Todays guest is Jackson Queen, noted author of such bestselling works as "A Housewife's Handbook of Headless Husbands". Our interview takes place in the home of Mr. Queen. And here is your host, Dick Shunery. Take it away, Dick.

**Dick:** Thank you and welcome to another edition of "Words Worth", and thank you for being here, Mr. Queen. I know your policy about not giving interviews but I'm glad that you decided to be with use today.

**Queen:** You're quite welcome, Dick. And as the audience may have been able to figure out, today's word is "horror". Horror is defined as a strong feeling of aversion mingled with dread. This feeling is excited by something shocking or frightful.

**Dick:** That's quite an accurate description; at least, I think it is. But how exactly did the word horror originate?

**Queen:** The word horror, in terms of its association with fear, arose from another definition of the word. The word horror also refers to shuddering or shivering as a symptom of disease. When someone realized that the same shuddering occurred

as a result of fear, it was applied to this as well. Thus, horror has come into its own. Strange as it may seem, horror also used to mean roughness or ruggedness. Through extensive use, however, it was eventually replaced with the word "horrid".

**Dick:** That's very interesting, (the arms of the chair that Dick is sitting in transform themselves into long, muscular arms ending in two monstrously large claws). And how do you, as a horror author, view this definition of horror?

**Queen:** I believe that it is completely accurate and boas the intentions of my books upon that definition.

**Dick:** Then, how can you call yourself a horror author when all that you write is simple "hack-and-slash and slice-and-dice" novels which aren't scary or horrifying, but only sick and disgusting?

**Queen:** One man's disgusting is another man's terrifying. And I believe that you have overstayed your welcome!
*(Queen snaps his fingers and the arms make their way towards Dick's throat).*

**Dick:** This interview isn't over yet. You . . .
*(Dick's words are cut off in his throat as the two claws take hold and quickly cut off his air supply, as well as his life).*

**Queen:** This is Jackson Queen, signing off another week's episode of "Words Worth". And please remember that when talking to a true master of the horrific arts, one man's fiction is another man's fact. Also, the next time that you are at the bookstore, pick up a copy of my latest book, "Killing Kids for Kicks" or, you might be my next houseguest.

# Video to Slides - Quick and Cheap

**Terry J. Gillespie**
Department of Land Resource Science
University of Guelph

Do you have a need to transfer tidbits from a video presentation onto 35mm slides for classroom use? This can be done with quite reasonable quality using a colour television monitor and a 35mm camera.

My particular application is in the teaching of meteorology. I strongly believe that an immediate connection between classroom experience and the current weather outdoors is a powerful teaching tool. So I need today's weather in slide format... today! Although I have an urgent requirement for rapid creation of my slides, the transfer of video to slides may be a useful technique for any teaching application where low cost is desirable.

Each morning of the week I videotape the excellent Public Broadcasting System program called A.M. Weather, making notes about particularly interesting features of the maps or satellite images. Early on Friday I photograph the screen images I want to use from these tapes and rush the film to the photographic section of the Office for Educational Practice, where it is processed by about 11:00. This gives me ample time to prepare a slide-illustrated review of the week's weather, and the weekend forecast, before my afternoon class.

A high-quality television monitor should be used, and the 35mm camera should be capable of focussing close enough to fill the whole frame with the television picture (a "macro" lens may be required on the camera). In order to get an evenly "painted" slide, the camera shutter must remain open while the video screen is refreshed several times in an otherwise dimly lighted room. Screen refreshment occurs at 1/30 second intervals, so a shutter speed of 1/8 second works well. With Ektachrome 100 ASA film, a meter reading on my screen suggests an aperture of f/11, and this produces good results.

Slides of very acceptable quality for classroom use may be produced quickly from video in this way, using a readily-available 35mm camera. The weekly weather map and forecast discussion built around these slides has become a valuable component of my course presentation.

Research and Development

# Software Development Guidelines

by Jim Greer, Manager of Interactive Information Systems, R&D

This guide was produced for those developing software through Sheridan College's Research and Development function.

Photocopying of this material is encouraged, as long as the original source is noted and the reproduced materials are not sold. For information about R&D, or for additional copies of this booklet, please call (416) 845-9430, ext. 277.

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Research and Development

# Software Development Guidelines

## Introduction

This is a a guide for project managers who are planning to develop computer software. It provides an overview of the software development process, describes some of the problems that you might encounter and explains what is expected of you as project manager.

Developing computer software requires a fair amount of planning. As you will note in these guidelines, most of the planning process should happen long before the programming has started. By doing this you will reduce the problems during the programming phase and be better ab'e to complete your project on time and within budget.

R&D staff are available to assist you with any aspect of project management and software development.

Software Development Phases

1. **Initiation:** Clarifying your idea.
2. **Requirements Analysis:** What are you going to need?
3. **Design:** Specifications of requirements and production planning.
4. **Programming:** Coding of the design.
5. **Testing:** Does it work?
6. **Operation:** Using the software.
7. **Maintenance and Enhancement**

## Deliverables

Once your project has been completed you will be required to provide Research and Development with:

- one copy of the final **executable software** product (on disk)
- a copy of all **source code** (on disk)
- a copy of Makefile (if you have used one) or **written instructions on how to compile software** and what order modules have to be in to compile and link
- copies of all supporting documents, such as **user guides, workbooks, installation guide, etc.**
- copies of **all documentation, flowcharts, pseudo-code etc.** as outlined in the guidelines.

Phase 1&2

## Phase 1. Initiation: Clarifying your ideas

What is it you would like to do? Try to clarify your idea by talking with R&D staff or someone on the R&D committee. Talk to your Dean, Director and associates to get initial feedback and support for your idea.

## Phase 2. Requirements Analysis: What are you going to need

**Objectives** - what are the **objectives** of the software?

**Choice of medium** - have you thought of alternatives to developing this software? Is it appropriate to computerize, or can your goal be achieved more effectively in another way?

**Technical requirements** - list what is required to develop your idea, such as:
- **hardware configuration** (minimum and ideal)
- what **peripheral devices** are needed (ie. printers, hard disk, color monitor etc.)?
- is **special software** required (ie. libraries, spreadsheet or database)?
- what **special interfaces** are required?

**Market** - what market are you designing the software for (college, high school, primary school, general public, etc.)? What are the characteristics of the market?

**Production management** - how is the project to be managed? Make sure there is a proper reporting system between all involved in the development.

**Tasks** - who are the **people and skills** that will be needed for production of the software? (R&D staff can assist you in identifying skilled people for your needs.)
- for how long will these people be required (you need to know this for budget preparation)
- consider using a contract when hiring programmers, instructional developers, computer graphic artists, etc. (Manager of Interactive Information Systems Jim Greer can provide assistance and sample contracts. )

**Document all of this; you will need to refer to it later.**

Phase 3

## Phase 3. Design: Specifications and production planning

Specify the automated and manual functions and procedures, the computer programs, and data storage techniques that meet the requirements identified in Phase 2.

Software Libraries - specify what **software libraries** you will be using (if applicable).

Graphics Standards - if graphics are required, what **graphics standard** is going to be used?

File Format - what **file format** or data structure are you planning to use? Make it simple.

Portability - Have you considered the possibility of porting the software to other types of computers (e.g., Apple, IBM, Atari, ICON, etc.)?
- are there any **special dependencies**, on a certain piece of hardware or an existing piece of software? **Try not to make the software machine- or terminal- dependent.**

Design - consult with an instructional designer and graphics specialist to get tips on **screen design** and **content structure.**

Flowchart - with the help of a systems analyst or your programmer, prepare **detailed flowcharts** (or **pseudo-code**) of the process. (A flowchart is a flow diagram of how the program is going to work, where processes lead, and which screens appear after certain decisions are made, etc. Pseudo-code is basically a plain English version of the steps that will be required to write the program.) Your programmer will need this information.

Scripting/Storyboarding - with the help of an instructional designer and/or writer you should prepare a script of what **will be on each screen.** This is necessary if you are developing courseware and would be of help if you are developing other types of software.

Check - check the flowchart : **make sure that it is viable and that error checking procedures are included.** This is important, as it is the last check before the programs are coded.

Production Schedule - what is the duration of the project? Set a production schedule and try to stick with it.

Document - document all this information; this is an important phase in the software development and **your programmer(s) will need all the information that you can give them.**

Phase 4

## Phase 4. Programming: Coding of the design

Check for completeness - make sure flowcharts or pseudo-code is complete and that your programmers **understand what is required.** Make sure programmers work from the flowcharts (or pseudo-code).

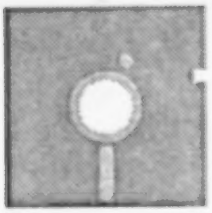
Follow plan - stick to the (instructional) design of the content . Try to **modularize the code;** it will be much easier to program and to document.

Check for efficiency - is the code efficient? Try not to get too fancy. The best code is clear and easy to follow. **Make sure you are using the appropriate programming language for the software that you are developing and that you can meet all the design criteria with it.**

**Choosing the appropriate programming language** - There exists a great selection of programming languages and solutions for your programming needs. Most languages are designed with a specific task in mind. There are two areas for consideration.

Data type
- Are you working mainly with **text?** If so you may want to consider a language that has an instruction set and library rich in string handling routines (such as C, Basic ).
- Do you need to **manipulate individual bits of data?** Certain languages are better adapted to this task (Assembler, C... ).
- Is most of the data that you intend to work with **numeric?** Scientific languages may provide the solution (FORTRAN, Pascal, PL/1, C...).
- **Graphics** are becoming more prevalent in computer work. Tools for effective development are available.

Process
- **Presenting frames of text or text/graphics** can be accomplished with a number of products:
  - native programming languages (ie. Basic, FORTRAN, Assembler)
  - authoring languages and systems (Natal)
  - database languages as found in dBase
- Do you need to **control external processes** such as a videodisk or some other hardware device? Special languages have been developed to incorporate this capability. Some native languages give access to the full range of I/O control (C, Assembler...).
- **Complex calculations or number crunching** can be successfully programmed in a scientific language as well as in spread sheet programs. (There may be additional costs if using a spreadsheet.)



## Phase 4

- Data base languages provide simple solutions to the problems of accessing wide ranges of data that can be tapped by computer. Expert system shells provide another useful solution.
- In certain applications speed is critical. Machine level languages (such as Assembler) may be the solution.
- If there is a high degree of interaction between the user and the software, a screen and keyboard oriented language may be the solution.

Other points to ponder

- Often there is no one language that fits all your needs. It is possible to connect modules developed in different languages to produce the most effective solution.
- Identifying the available resources may narrow the choice of language. Be wary of choosing a solution for which there is little on-site support.

NOTE: There are several books on programming standards and style available from the R&D library. One that you may want to refer to is *The Elements of Programming Style* by Kernighan and Plauger. (Also, see the list of reference books at end of these guidelines.)

Document source code

- Document all source code, especially special routines or modules within your programs.

Some other hints for documenting programs:

- try not to put too many comments in the header of the program. Concisely explain what the program/ subroutine/ module does in general.
- put descriptions of variables as close to the variable declaration as possible. This will help eliminate some of the overly long descriptions at the beginning of the program.
- emphasize the documentation of the variables and the data-structures rather than the algorithms.

Contract

- Helpful hints: Think about putting your programmer(s) under a contract. This may help solve some problems you may encounter later in the development of the software and would spell out what is expected of everyone involved. Make sure the contract states that the College will retain ownership of all computer programs and modules developed by the programmer(s) unless specifically stated. (See Jim Greer for more information.)

If you are using students to do the programming, consider their school work load as well as their ability to do the programming. It would be a good idea to have someone from R&D meet with them and explain what is expected regarding the style of programming and the documentation required. It may also be helpful to have an R&D staff member assist with the supervision of the programmer(s).

## Phase 5. Testing: Does it work?

Test
- make sure that your software works as intended.
- thoroughly test for any possible **combination of data** that could be entered. Make sure error routines are working properly.
- have an **instructional designer** test the software. They check the instructional design, and can evaluate a variety of aspects including sentence structure and overall look on the screen.
- it is important to have **someone outside of your project team** test the software. They may find something that you have overlooked or taken for granted.
- document test results and any other findings; you may need these for your final report to the R&D Committee.

## Phase 6. Operation: Using the software

Protection
- once the product is ready for use you should consider **security, protection** and **copyright** of the software, if you have not already done so.

Documentation
- you should, by this stage have a full set of documentation for the software. You should have further documentation that shows the **procedures** that are required **to compile the software** and **link modules,** etc. This is important for future maintenance and enhancements.
- consider using a **build.com** or **makefile,** not only to make the compile and link processes easier, but also to reduce the risk of errors when updates are made.
- you should have a complete set of **installation** and **user instructions** for the product, keeping in mind how the user is likely to use your software. For example, different installation instructions may be required for running your software on a single computer and on a network.

Phase 7

## Phase 7. Maintenance and Enhancement

Updates
- as the software is used, you may find that you will want to make changes in order to enhance its **performance** or increase its **capabilities.**
- make sure that the software is easily maintainable. Make sure your documentation is complete and that you have **copies of all modules** that were developed for use in the software.
- are there software modules that were developed that could be put into a **library** so other software projects could use them?
- complete copies of all source code, final executable code and documentation will be required when the project is completed. These copies will be kept in a fire-proof safe for protection and safekeeping by Research and Development.

## Resources:

**Partial Listing of Reference books:**

*The Art of Software Testing* - Gelford J Myers
*The Elements of Programming Style* - Kernighan & Plauger
*Computer Based Instruction - Methods & Development* - Alessi & Trollip
*Making CBT Happen* - Gloria Gery
*The Computer Documentation Kit* - Diana Patterson
*Programming in C* - Stephen Kochan
*A Workbook in C* - Joseph Sant
*The Instructional Design Process* - Jerrold E. Kemp
*Principles of Instructional Design* - Gagné & Briggs
*The Human Factor: Designing Computer Systems for People* - Rubinstein and Hirsch
*Guidelines for Learner-Computer Interaction in Independent Learning Centre Courseware* - Robert Jones

# Educational Delivery Models Using Computer Databases

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## Introduction

The amount of information presented in most disciplines can easily overwhelm a student who is either unprepared or unable to manage that information for learning. To assist the student in mastering a field of study, we must thus educate our students in information management until they become deeply rooted in an effective educational paradigm.

In 1985, the University of Windsor entered a Joint Effort Agreement with IBM of Canada Limited. This allowed both extensive prototyping and in-course applications of educational delivery models that incorporated database concepts. The purpose of this endeavor was not only to obtain a higher level of learning for students through the use of this technology, but also to provide insight into the practice of teaching. (Hogue, Sands, Habowsky and Stager, 1987)

## Database Concepts

The database represents the use of forms for information storage, search and retrieval. All information in the database is treated as being of the same level of organization. An example application of such a database would be the names and physical features of the planets. A database of this nature can be created with most popular database programs.

In our work, we have used the IBM Filing Assistant* and 3by5‡ to create such a database. It was found that students could become better acquainted and subsequently more proficient with the database if it first involved data that they were not responsible for learning. Furthermore, questions by students would be more related to the method of teaching, the nature of the database, or the computer system in general, rather than the information content of the database.

## Student Database Development

Once students mastered concepts associated with the database, they then used it to assist them with their course content. In Biology, students enrolled in Cytology are presented with a pre-defined form on which to categorize different types of animal cells on the basis of their structure and function.

Similarly, students in Histology used the same database concept, with a more complex course content. Information obtained from the prerequisite course in Cytology was quickly and effectively organized. Throughout the course, information related to the histology of animal cells, presented by lectures, was added to the database by the students. The end product was a detailed and dynamic summary of course content that was readily available and accessible.

Students in a first year Engineering course (Computer-Aided Analyis and Design) also created databases as an integral portion of the design work. Students were asked to manage not only collected facts, but also ideas generated as a part of open-ended problem solving.

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* IBM of Canada Limited

‡ Softshell Corp

## Prepared Databases as Resources

Suitable databases can be created and maintained by an instructor and used as resource material. Students in Cytology also have at their disposal a database of plant tissue and cell information, compiled by S. N. Postlethwait. This resource was coupled with a computer controlled videodisc (BioSci). Software created at the University of Windsor by C.W.V. Hogue allowed the botany and histology sections of the laserdisc to be accessed as a database of images.

Students in Engineering developed their own database resources. The entire first-year class prepared an extensive database of articles on bicycles, to be used in conjunction with a major project. The work of several groups was merged into a single database available to all individuals. This resource can be used for future classes.

## Conclusions

Media technologies have been implemented into the practices of teaching and learning for approximately the last thirty years. During this time, continuing developments of the technologies and their applications have resulted in successful, technically innovative, teaching regimes. We have found that an introduction of computers, videodisc and database software into the teaching environment most effective. The use of the Interactive Audio Cassette (IAC) has proven to be a simple and effective means of introducing the software, hardware and its use. Databases show much promise as learning tools for students. Although their creation and use has provided a future resource, the proper integration of these tools into the learning environment are the key to their success.

Hogue, C.W.V., Sands, T. W., Habowsky, J.E.J., and Stager, R. A., Database Creation and Use in a Learning Environment. Presented at the Ontario Universities Instructional Technology "Show and Tell", University of Guelph, May 1-3, 1987

# The Evolution of Individualized Instruction Using Electronic Media Technologies

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## Preface

In North America in the early nineteen sixties, INDIVIDUALIZED INSTRUCTION (II), emerging from developments in media-technology, was born: the student applies himself/herself on an individual basis by means of various media (closed-circuit TV, audio-cassettes, video, computer and more recently the video disk) according to his/her rate of learning, level of knowledge and receptivity.

The author is of the opinion, that this system which proved its worth in Canada and the USA also presents a solution to high enrollments as well as a means of improving the quality of education in Germany. The impact of distance learning is not dealt with in this paper.

## 1. The Use of the Monitor

### (a) Development

Towards the end of the fifties some reasonably-priced combinations of TV-Cameras and monitors became commercially available. It is more than likely that not only the Zoologist Prof. Beckel thought of the idea to put such technological devices into teaching; in 1959 he introduced a closed-circuit TV-system into the laboratory portion of the first year zoology course, Department of Zoology, University of Toronto, Ontario, Canada. Since I was a Ph. D. student of Prof. Beckel and assisted in this laboratory course, I got also involved in the use of this teaching aid.

One was of the opinion that the students are not only better served to learn hands-on work in the laboratory, but also that this closed-circuit TV-system, can cope with increasing enrollments. The monitor made it possible not only to present the pre-laboratory discussion, demonstration and on the spot help during the laboratory period, but particularly to demonstrate minute details (for example portions of a cell seen through the light microscope). This system also enabled information to be delivered to any location within the laboratory, thus finally avoiding crowding around demonstration tables as well as the need for an instructor to repeat a demonstration again and again to successive groups of students.

Because one could instruct via this system in several physically separated laboratories, it was now possible to also stay within the financial budget, heavily burdened from increasing student enrollments: the use of closed-circuit TV permitted the liberation of instructors from unnecessary repetitions of presentations and allowed an instructor to address all students from a central location, simultaneously. The subsequent practical part of the laboratory period was mediated by means of teaching assistants. In principle the central location of delivery comprised two TV-cameras, one directed to the instructor, the other supplemented the instructor's demonstrations or experiments (equipment, pictures through the microscope, trick-demonstrations). Besides Prof. Beckel, Profs. Friend and Riggler also participated in these laboratories in part as guests, or used this system in their own courses.

In summary: the use of the closed-circuit in TV-teaching and learning opened up a new era in education for both teachers and students alike. The success of this introduction of media-technology at the University of Toronto, led to its adoption by other Universities. A similar system of instruction was started in the laboratory course of first year biology in the Biology Department of Queen's University, Kingston, Ontario; it was technologically improved by the use of a "feed-back-system", by means of which the student was able to communicate with the centre desk. In 1962 Scarborough College, a satellite campus of the University of Toronto was in the planning stages. Prof. Beckel, future Dean of the College, incorporated the closed-circuit TV-system as an integral part of the teaching and learning approach to the College. Further, in a new building of the University of Toronto, the Ramsay-Wright Zoological Laboratories, monitors were installed in lecture rooms as a teaching tool.

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Translation of a German paper distributed to all Ministries of Education, Industry, and Universities in the Federal Republic of Germany.

Thanks are expressed to Dr. Lullies, Director, Bavarian State Institut for University Research and Planning; Munich, Germany, for inviting me to write this position paper (Beiträge zur Hochschulforschung, Nr. 4: 255-266, 1983).

### (b) Present State of Developments

Towards the end of the sixties the application of closed-circuit TV to instruction had passed its peak; initially it was thought to be the only practical answer to the teaching dilemma, imposed by ever increasing enrollment; this system was thought of as intermediate channel between teachers and students, by which to improve costs and effectiveness in teaching. This became particularly apparent: enrollments continued to escalate, which made this system again a limiting factor, mainly because technology for video RECORDING was at the time in its infancy.

Developments in other Universities looked for media applications which enabled re-play of teaching programs once they were recorded; these developments took place parallel to that of the closed-circuit TV-system and were so successful, that gradually the TV-monitor lost in significance as a primary teaching aid. Regardless the closed-circuit TV-system remains a useful teaching tool at many Universities in Canada and the USA, since video-recorders (although expensive) now provide convenient storage and re-play of programs, while "life" presentations are important for teaching (e.g. surgery).

## 2. The Use of Audio Playback

### (a) Development

In the Department of Biological Sciences, Purdue University, Lafayette, Indiana, USA, the Botanist Prof. Postlethwait was concerned about the high failure rate in his basic Plant Science course; he thought that three factors seem to relate to this problem: high enrollments, the variable levels of knowledge of incoming students and individual differences in learning ability. To assist those less successful students, Prof. Postlethwait initially had his lectures recorded and provided tapes to students, who wanted this extra help. This possibility of repetition of the lecture became so popular, that a majority of students in his course requested the opportunity of listening to the recorded lectures. Because of this positive attitude of students to the use of a tape recorder in learning, Prof. Postlethwait introduced this medium in 1961 in a portion of the laboratory part of the first year botany course for further testing; based on the positive results he fully implemented and developed the use of the tape recorder into the entire course*. This new "Audio-Tutorial" method in teaching is composed of the following elements:

- a Learning Centre with study carrels and extended open hours, allowing individual students to develop their own timetables, or to repeat each lesson as often as they require;

- audio visual programs in which the subject matter was organized with great care, using illustrative and written material are provided at these study carrels;

- especially defined learning objectives allow the student at any time to monitor his/her progress;

- a tutor is always on hand to help immediately to discuss, with the student, problems as they arise from the learning material.

In particular it should be pointed out that the student is now in the position to individually control/adjust the delivery rate of the new subject matter according to his/her background knowledge and according to his/her ability. Additional advantages are that a program can be repeated as often as the student wishes and that the variable level of knowledge of the incoming student can now be accommodated. Due to the extended opening times of the Learning Centre, the student can evolve his own timetable. Of economical importance is the fact that a relatively small number of study carrels can accommodate a large number of students.

While in the conventional mode of mass-teaching students play rather a passive role, in "Audio-Tutorial" they are the centre of the teaching-learning process. Postlethwait formulates his fundamental thesis as follows:

"Learning is an activity done by an individual and not something done to an individual".....

It was soon recognized that the Audio-Tutorial System (AT) is applicable not only to the natural sciences, but also to other disciplines; further it was realized that this system is ideally suited to accommodate the increasing enrollments at Universities and simultaneously improving the quality of education. Other advantages were the overwhelming acceptance of this system by the students and - in the long run - the savings in costs, accomplished through the use of media-technology.

The Learning Centre at Purdue University was frequently visited by scientists and teachers from all levels of education; visitors were interested in studying AT and in assessing possible implementations of this system at their own Institutions.

In 1969 Prof. Postlethwait initiated the "Mini-Course", which is a well defined topic developed as a learning module, for example, "Mitosis" as part of a biology course; it was thought that centrally produced AV-programs in fundamental themes in Biology, would assist instructors and could be tailored to specific needs or requirements at different Universities. Towards the middle of the seventies minicourses for most topics in Biology were completed and became commercially available.

In 1971 the "International Audio-Tutorial Congress" was started; at the annual conferences of this Congress, held in various parts of the USA and Canada, workshops were organized to introduce teachers at all levels of education to this mode of instruction. Additional applications of media-technology to teaching and learning were also reported. In 1976 this Congress adopted the name "International Congress of Individualized Instruction" in recognition of the central role of individualization as a goal in teaching and learning. Since 1982 the Congress named itself "International Society of Individualized Instruction" (ISII), because other interest groups joined: Computer Assisted Instruction, Guided Design, Feed-Back Lecture, and Personalized System of Instruction.

### (b) The Present and the Future

The application of media-technology to personalized teaching and learning that is "Individualized Instruction" has over the years permeated Universities in North America, with an emphasis on the core courses for the different programs; given the fact II has become a standard method, it is not too presumptuous to expect, that present enlistment of the computer as an interactive learning aid and the incorporation of the video-disc, will continue to liberate teachers to some extent from routine mechanical tasks, making them more available as TUTORS in this individualized format of instruction. As was stated earlier, II not only proved itself as an economic "delivery system" at high enrollment levels but could be used simultaneously to improve the quality in education.

## 3. Developments for Multiple Use of the Learning Centre

In 1969 Prof. des S. Thomas and I developed the first Learning Centre in Canada, in the Department of Biology, University of Windsor. Due to increasing enrollment not only were we limited in space, equipment and even scheduling of the laboratory portions of certain courses (cytology, histology) but also faced declining qualities in the "hands on" learning activities. In the planning (different from Postlethwait) we combined the laboratory portions of several courses: cytology, histology, plant anatomy, mycology, and electron microscopy into a single Learning Centre. Using funds from the "house-keeping budget" from the Department, we ourselves converted (with the help of Mr. H. van der Burg) the conventional laboratory (Fig. 1) to the Learning Centre (Fig. 2). It consisted of six "Tut-stations" (study places, in contrast to Postlethwait's were equipped with inexpensive Panasonic audio cassette play-back units), one "video corner" to view slides, film strips etc. (some of which we produced ourselves), integrated into modules, which we called "Tuts". These tuts were produced over a period of one and a half years and consisted of a "Tut-Book" (adopted in 1976 by the University of Cologne, Germany). Each Tut-Book is designed around a defined topic, and incorporates illustrative and written material, experiments or exercises all integrated by the audio tape into an AV-learning package (the "Tut"); at intervals the student is asked to view slides or film loops at the "video corner" or other appropriate materials. These "Tut-Books" were freely available to the students, so they could proceed at their own rate through the program (Fig. 3).

In 1972 we also developed a concept which we called "Textape", where instead of the Tut-Book a standard well illustrated textbook is used. In 1974 we also started using variable speed play-back units; in this way the student can also determine the rate of speed (= learning tempo) of the audio cassettes, based on a higher rate of compression. In 1982 we began to use the computer in individualized instruction.

Based on the program of studies, the students could develop their own timetables, or work in pairs (Fig. 4). Also of significance was that a Tutor was present when the centre was open. Weekly discussion in small groups and a test, as a control mechanism, helped us to implement individualized instruction.

From 1970-75 we also tested a variety of combinations in II; for example we replaced the lecture with discussion of problem questions; factual information was transmitted to the students in the form of homework, in its total concept similar to the principles of learning in the "Harvard Case Method". From the tests conducted it was obvious, that "Tut-Stations", in combination with the "Tut-Book", "Textape" and "Tutorials" are the framework of individualized instruction; it is also an economical combination. Regarding the success of this method in learning, I would like to cite one example: students who received an A or A+ in histology were exempted from this course if they went on to study medicine or dentistry in Ontario.

In 1976 we developed plans for an enlarged Learning Centre; also the basic course in Biology (where II was also implemented in 1971 in a separate area) was to be included. The new Centre has been in use since 1977. At present the number of student using this facility corresponds to approximately 700 course units annually distributed among seven different laboratory portions of courses and scheduled concurrently within th year; a total number of 53 Tut-Stations are sufficient (Figs. 5 and 6). Demonstration tables for dry and wet experiment are placed in such a manner that they are easily reached from our Tut-Stations. Of particular importance to us was the aesthetic aspect of this Centre; carpeting, a friendly colour scheme throughout the laboratory, plus plants and animals (aquarium) were included (Fig. 7). In the "Video-Bar" (a small room equipped with AV play-back units) students watch video-programs; this Bar is also used by students for programs in senior courses. A cozy corner next to the video-bar (Fig. 8) has a mini-library and contains reference books, integrated in the program of studies; this corner is often used for discussions of just to take a break. An "antique" electron microscope adorns this area and is to be merged into the learning programs.

In the Federal Republic of Germany the principle of II was introduced in 1974 at the University of Cologne in the course "Biology for Medical Students". The successful use of the "Video-Album", totally identical with the

concept of our Tut-Book, which Dr. Hoffmann got to know when he visited us in the Department of Biology, University of Windsor (November 24-25, 1976); further it also presents a direct transfer of II into the German milieu*. Also at the Technical University of Munich I initiated in December 1983 a pilot project in the Department of Physics, Mathematics, and Botany.

## Addendum

In the spring of 1971, Prof. W. G. Friend and other members of the Ramsay Wright Zoological Laboratories, University of Toronto, visited me, to acquaint themselves with "Individualized Instruction" and its implementation in our Learning Centre. According to a report (Globe and Mail, January 27th, 1972) this mode of learning was started in 1972 and has operated since then.

November 30th to December 1st, 1982 Prof J. MacLachlan, External Consultant to the Ontario Council on Graduate Studies, on the Graduate Program in Biology at the University of Windsor, in his final report states:

> "Windsor University, and Biology in particular, is well-known in Canada for its innovative procedures in teaching methods. It was one of the first to develop cost-efficient and effective teaching devices which allowed students to pace themselves with audio-tutorial and computer-aided methods. These techniques have been well-publicized and adopted by many other Universities in Canada. They are appropriate for and have been applied to Undergraduate instruction,.... Windsor is to be congratulated on achieving distinction in this area in Canada...."

* B. Hoffmann und E. Eickhoff, 1977. Individuelles Lernen mit AV-Programmen, Hochschuldidaktische Materialien, Heft 63.

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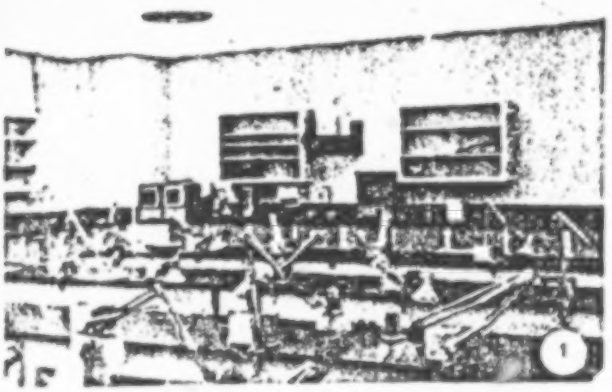

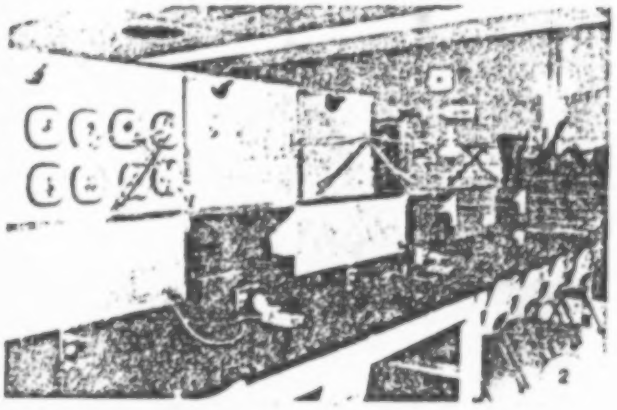

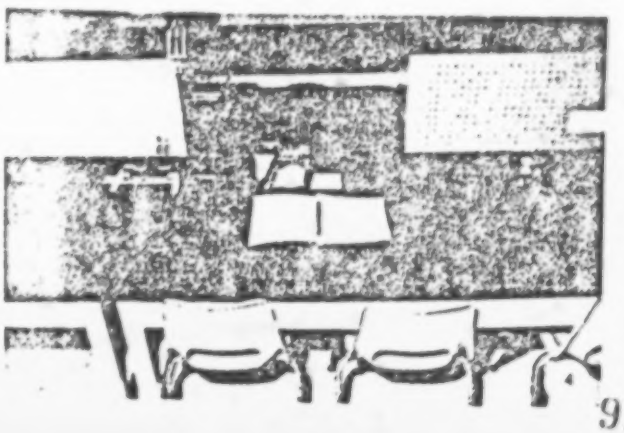

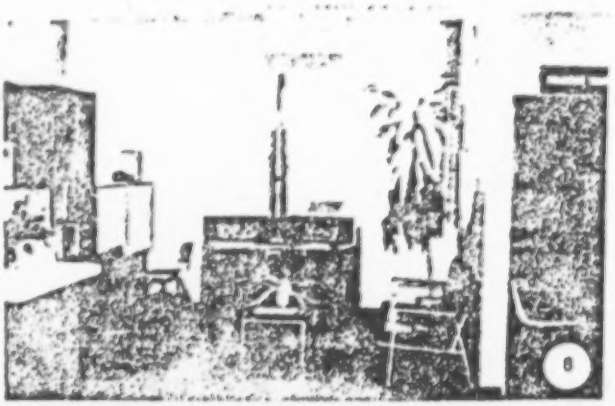

# Interactive Audio: The Unifying Thread in Multi-Media and Computer Assisted Instruction

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## Introduction

Over the past 30 years, the evolution of media technology has provided education with exciting new electronic technologies for the delivery of information. Three notable applications were Instructional Television (ITV) in the late fifties (Habowsky, 1983), Audio-Tutorial (A-T) in the early sixites (Postlethwait, Novak, Murry, 1964), and Computer Assisted Instruction (CAI) in the early eighties (Bork, 1981). Such applications have brought forth new instructional paradigms and each in turn was praised as the ultimate in teaching and learning.

Since 1969, at the University of Windsor, we have applied media technologies in the teaching and learning process (Habowsky, 1983; Thomas, Habowsky, Van der Burg, 1971). The laboratory portions of several biology courses were incorporated into a single facility for multiple use. In the Biolearning Centre students use multi-media study-stations and modularized activities. Each activity entails several laboratory skills which are presented on separate audio cassettes.

Success in such a multi-media learning centre is based on one's ability and desire to both modularly and meaningfully implement these technologies (Habowsky, 1983). A corequisite in this approach is to also provide the "personal attention" which students need, as advocated by the proponents of the "Personalized Systems of Instruction" (Keller, Sherman, 1964).

## Interactive Audio

In 1985, the Joint Effort Agreement between the University of Windsor and IBM of Canada Limited, provided both computer hardware and software to further this work. We have employed the portable tape recorder to selectively integrate this computer technology with existing and successful media. In this approach the instructor has the "freedom to eliminate, enhance, or emphasize information".

The "Interactive Audio Cassette" (IAC) provides students with personalized instruction in both content and hands-on skills in specific study areas (Habowsky, Postlethwait, Stager, Hogue, Glasgow, 1987). The IAC was used to integrate: a) instructions for computer hardware use, b) commercial CAI packages for content delivery, c) instructions for traditional software applications (i.e. word processor, database), and d) specialized content delivery with the above software. These applications continue to evolve as successful tools in education.

## Discussion and Conclusions

Based on our experience, no "single technology" should be implemented for the delivery of information in teaching and learning. When the computer is used as the sole delivery tool, we encountered the same problems of acceptance or expectations as with previous technologies (Habowsky, 1983).

The joining of multi-media and CAI, with the Interactive Audio Cassette acting as a unifying thread, has successfully integrated these technologies. Overall, this provides the instructor with more time to improve both the quality and effectiveness of teaching and learning. We invite more educators to become users of this unique approach.

The senior author is a Cell Biologist and has been active to improve teaching and learning since 1960, when ITV was introduced at the University of Toronto, Ontario, Canada; he has published several articles in educational research and conducted workshops in Canada, Germany and U.S.A.

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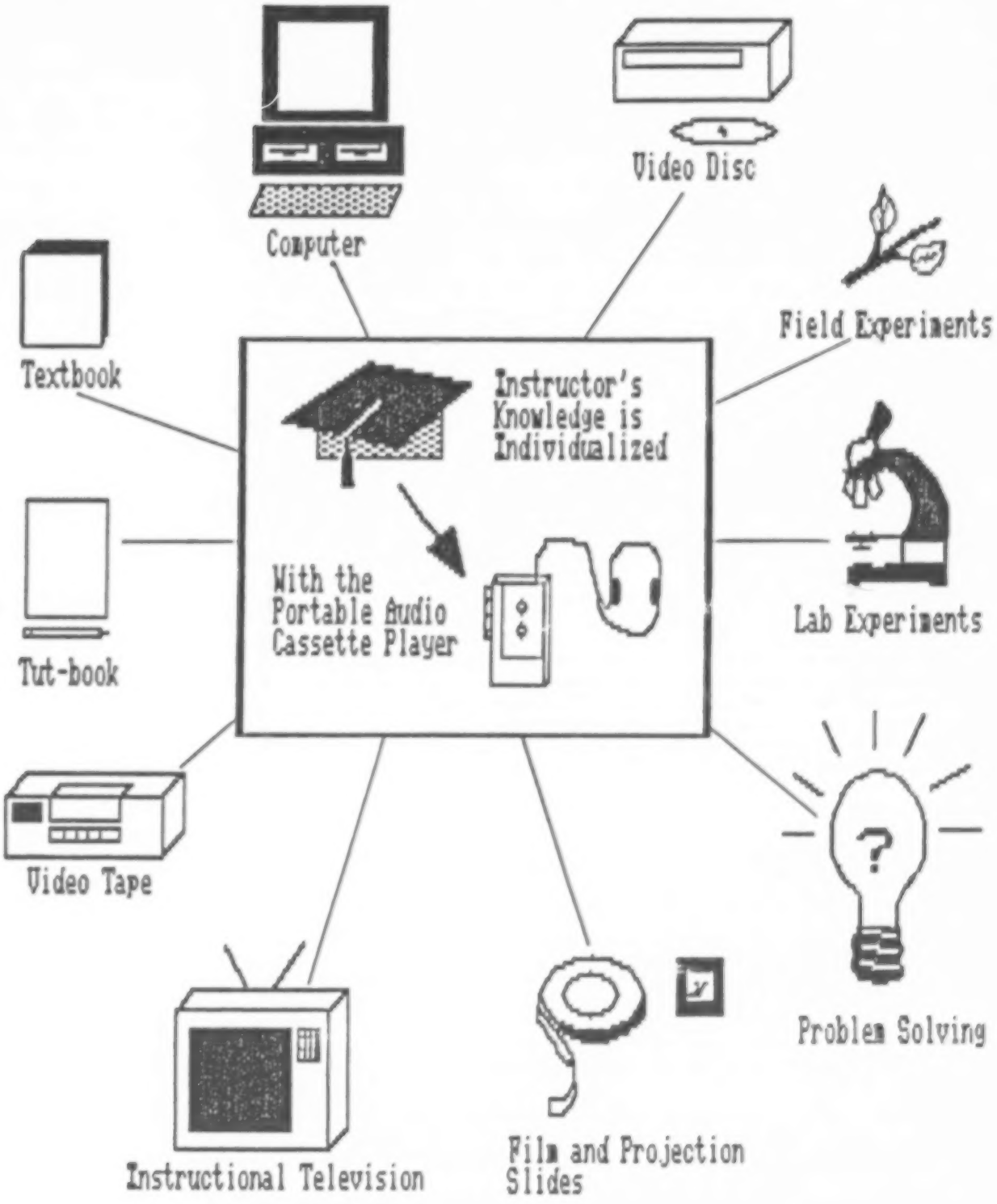


The Interactive Audio Cassette In Multimedia Instruction

# Interactive Teaching in Agricultural Botany

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Teaching introductory courses at the University provides a special challenge to the instructor. There is the need to cover all the basics on which more advanced courses depend, while at the same time to motivate the students to learn and retain the basic concepts that they are being taught. Different instructors use a wide variety of techniques to encourage understanding and retention by the students.

Introductory science courses tend to have a high failure rate. The students come with a wide range of backgrounds to the subject, as well as a wide range of interests. Because the amount of factual information is often high in these courses, slower students encounter a great deal of difficulty keeping up with the class.

In subjects where there is an aversion to the material by a substantial number of students, the problems associated with instruction are exaggerated. Subject matter considered dull or uninteresting by the student is often arduous to teach and is almost impossible to stimulate the students to learn the requisite concepts.

## THE SPECIFIC PROBLEM

All the students entering the first semester of the Diploma Program in Agriculture are required to take the course Agricultural Botany. Less than half of those students will continue in programs related to plants, like crop production and horticulture. The remainder will be in programs not directly related to plant growth or crop cultivation. The majority of the students that are not pursuing careers related directly to the propagation of plants have little or no interest in botany, with some even expressing an active dislike.

The students entering the Diploma Program are frequently more diverse in their backgrounds then degree students. A high proportion are mature students who have been in the work force for some time after having left highschool from different grades and various programs. Those coming directly from highschool also come with a wide variety of backgrounds and abilities. A large proportion of the students have not been in the academic stream, and are frequently missing some basic courses.

There are students entering the program on the other hand, who have a very good preparation in the sciences. If the course is taught at the level to meet the needs of the poorly prepared students, the others will be bored with all the repetition, creating unrest in the classroom or poor attendance with its inevitable consequence of poor grades.

The task is then to bring along as much as possible those students with a weak background while not boring those with an adequate background. Remedial courses are not available in the sciences to the Diploma student.

These students are entering a practical program and on the whole they have a very practical approach to the material they need to learn. Knowledge for its own sake has limited appeal for these students. As long as there is meaning and application in what they are learning they are prepared to accept the information.

## STEPS TOWARD A SOLUTION

### A Suitable Textbook

One of the first steps that was undertaken was to prepare a text book and a lab manual suitable to the course. The text needed to be well illustrated with as many practical examples as possible, and written at a late highschool level.

**Enter the Computer**
The next step was to provide the students with an opportunity to learn at their own pace, with frequent feedback, using a format that was interesting and stimulating, but different from the other teaching methods to which they were being exposed. Modern technology using the computer, seemed a good way to go. Many students have used a computer and all the others will need to learn at some time during their program. Overcoming any fears about using the computer were anticipated to be minor.

**New Terms and Concepts**
In the course the student is required to learn a substantial number of terms, names of plant organs and tissues, with correct spelling, as well as a variety of concepts. VITAL offered a method of illustrating visually each new term and concepts as it was introduced. Most students are greatly assisted in learning if they write out their answers and have them corrected as they study. Therefore, a system of continual testing with instant feed-back was incorporated into the modules.

**Diversity in Approach**
VITAL allows for a diversity of approaches to presenting information, so that the manner of presentation need not become repetitive. With VITAL information can be presented as factual statements followed by questions to test comprehension, information can be presented graphically or pictorially, with or without animation, or it can be presented in the form of questions or puzzles requiring answers. The range of formats possible is determined by the imagination of the designer. A wide range of colors are available, greatly adding to the clarity and diversity of the presentation.

**Self-instruction**
The students can learn at their own pace, repeating the material if necessary. If they are fairly familiar with the material they can go directly to a test and bypass the reference material. It is possible to put in loops with remedial information for students that may be encountering difficulty with certain sections. The students can take a variety of paths through the module, according to their own level of understanding and speed of learning, i.e. the students are in control.

## SUMMARY

The important aspects of VITAL are: it is interactive, it is visual, it provides testing with immediate feedback, material can be presented in various imaginative ways, it is always available, it allows students to learn at their own pace when convenient for them.

## THE RESPONSE FROM STUDENTS

Several modules using a wide range of formats were developed and used in the fall for the first time. The material on the whole was enthusiastically received. Students had little trouble learning to use the computer set up for the VITAL modules. A half hour instruction was more than adequate for most students. The great majority (80%) of the students made use of the modules and found them interesting, enjoyable and very helpful. Those that did not use the modules cited lack of time on their part as the main reason.

An exam that had been used in previous years was used to evaluate the students after most of the modules had been presented. The average mark was increased by more than 5% and the failure rate markedly reduced. The second part of the course had limited information available in the form of VITAL modules and on the final exam, which was the same as the previous year, the students' performance dropped back to that of previous classes.

Many requests were received from the students during the latter part of the course for more modules, and there were frequent requests about other courses that might be employing this method of instruction.

## RESPONSE FROM THE INSTRUCTOR

The creation of the modules was very time consuming, and a person with artistic talent was essential for this course. The benefits were well worth the effort. Students enjoyed the course much more as a whole, and the instructor gained greater freedom in class to digress from some of the factual information that needed to be covered in the course. In summary, the course was made much more enjoyable to teach.

# Journals Across the Curriculum
# (Action Research Project)

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Since teachers at Sheridan College have busy and varied schedules, the opportunity to discuss, reflect and collaborate is rare. Presently, I am in the process of working on an action research project that I hope will offer one model of teacher collaboration and research.

Action research, sometimes referred to as classroom research, is not new. What makes this professional development strategy attractive and powerful is that it is teacher/student centred and initiated research: it is closely tied to the work the teacher does. Hopkins, in *A Teacher's Guide to Action Research* , refers to research as "an act undertaken by teachers either to improve their own or a colleague's teaching or to test the assumptions of educational theory or practice."

My interest in promoting and organizinging language and my committment to the writing across the curriculum initiative at the college led me to develop an R&D project that would investigate ways of achieving this goal. I settled on the uses of the journal in various disciplines as a focus. The journal has a proud history as a recorder of significant events and scientific findings, as a personal development log, as a creative book, and as a problem solving tool. It has been used creatively and effectively in both personal and professional contexts.

My action research project is involving, at this writing, 14 teachers from across the college who will have their students use the journal in a way that they think will enhance the student's learning experience. The schools represented in the project to date are Technology, Applied Arts, Business, Visual Arts and English/Language Arts. The participants will meet at the end of the semester to share their research with their colleagues.

# Electronic Technologies and the Intellectual Property Enclosure Movement

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*"If it's valuable it must belong to somebody."*
- from "On Being", by T. Terone

## INTRODUCTION

Last year my paper for this Guelph **Show & Tell** Conference was titled "Computer Supported Interactive Distance Education (CSIDE)". It started out as a paper on computer technologies and the learning process but ended up as a look at the potential for computers to transform the educational process. I argued that computers would be as revolutionary as Guttenberg's moveable type and the Copernican revolution. I saw the computer as placing the student and researcher at the centre of a personal galaxy of information sources, one which would break down the barriers of time and space in both intellectual enterprise and social discourse.

As I started this paper I planned to expand on the idea of Computer Supported Interactive Distance Education (CSIDE) and wed it to ways in which electronic technologies would transform participation in political and social affairs. This link between CSIDE and transformed participation in social and political affairs generated the term PICKNet in the title of the earlier working version of this paper, "CSIDE & PICKnet: The Shape of things to Come".

PICKNet stands for **Public Information to Common Knowledge Network**. It starts from the observation that much of useful information in the public domain goes unused because of the cost of access for particular interest groups. For example, the agendas of upcoming meetings for committees of city government provide an "early warning" system for issues of interest to groups in the community.

Special interest groups with a direct financial interest in city government (such as land developers) can finance the costs of monitoring city hall. Without funds or friends in city hall it is harder for other groups to keep abreast of issues coming up for action.

A PICKNet facility would envision, among other things, the routine posting of city hall meeting agendas to public access computers linked to distributed computer networks spread throughout the community. Node based networks, organized newsgroups, E-mail conferencing and the like would facilitate the dissemination of information across time and space in minimal time and at near zero cost. The original strategy of the paper was to expand on this optimistic scenario and link the Copernican revolution in education to a parallel revolution in the conversion of Public Information to Common Knowledge. As I researched the paper I again realized that the paper I wanted to write was not the one for which the title had been selected.

So, what is this presentation about? It is about dark clouds on the horizon, dark clouds brought on by the strengths, not the weaknesses in the emerging information technologies. There is not time to develope them in detail here so I will sketch out several topics and "flag" their more important aspects. Fortunately, the paper presented to the May 1987 **Show & Tell Conference** is a companion paper in this 1988 conference volume. It is titled "Computer Supported Distance Education (CSIDE)". This presentation deals with intellectual property rights within the context of a modern enclosure movement and begins to explore the implications for universities, society and democracy.

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* Dr. Lanfranco is also a Fellow of, and Computer and Communications Coordinator for, the York Centre for Research on Latin America and the Caribbean

## I. INTELLECTUAL PROPERTY RIGHTS: A MODERN "ENCLOSURE MOVEMENT"

It is useful to view current ferment around "intellectual property rights" as a modern day equivalent of the European "Enclosure Movement" aimed at the privatization of common lands. The Enclosure Movement culminated in the enclosure of common lands in England in the 16th Century. Common lands were progressively converted to private use as technology and market forces increased their value and made "shared use" less attractive to those best able to exploit new technologies and best located to influence the rule of law by the state.

By the 16th Century the emergence of "quality" breeding stock made the co-mingling livestock on common ground less attractive. The owners of "quality" bulls could neither restrict supply, nor charge a fee, for services rendered. Likewise, owners of "quality" cows were exposed to "production losses" from the degradation of offspring through random breeding. What had been viable as common property, the common lands, was progressively removed from common access and converted into private property.

Today, the growing importance of "knowledge" as a distinct factor of production and the rapid expansion of knowledge intensive industry, are producing a similar re-definition of intellectual property and the terms of access. It involves the intellectual property rights embodied in the rapidly growing "services" sector in the Modern economy. It is fitting to call this an "Intellectual Property Enclosure Movement". Below I explore it from the perspective of an economist, but first I shall give an example of the area of computer operating systems.

For the last several years there has been a growing fight over the type of operating system that will dominate the computer market. Operating systems range from the VMS/CMS operating systems of mainframe computers to the CP/M and MS/PC-DOS operating systems of microcomputers on to the UNIX based systems operating on a variety of computer systems. Two trends are clear from the fight. The first is that a single, relatively uniform, standard will emerge to govern the design of operating systems that operate across a wide range of computers from micros to mainframes. The second is a tendency to try to "capture" ownership of the winning operating system. Most operating systems have been "private property".

One might think of operating systems as equivalent to the electrical and hydraulic systems in an automobile. Operating systems are the basic command and communication programmes through which computer and peripheral operations are regulated. Most, such as the CP/CMS IBM mainframe operating system, are machine specific and private property (in the private domain). Some, such as UNIX, are neither machine specific nor private. They are effectively in the public domain. The equivalent to private operating systems for computers would be proprietary rights over the logical structure of he electrical and hydraulic systems in an automobile. The "logic" of the system would be privately owned and sold or licensed to end users (automobile users).

The micro-computer end of the computer market has been using private domain software, the bulk of which is IBM-PC compatible DOS operating software produced by MicroSoft Software. At the mid-range UNIX public domain software has been growing rapidly. For example, the very popular Sun mini-computers were built specifically to exploit the capabilities of the UNIX operating system. For reasons we need not detail here, UNIX as a non-proprietary system has been growing in popularity and is seen as a serious challenge to the proprietary DOS operating system.

This has triggered a dispute in which AT&T (US) and Sun Microsystems have been accused of scheming to take non-proprietary UNIX private while Apollo Computer Inc, Group Bull, Digital Equipment Corp., Hewlett-Packard Co, IBM Corp, Nixdorf Computer AG, and Siemens Aktiengesellschaft have banded together to create the Open Systems Foundation (OSF) with an initial endowment of $US 90 million and a mandate to develope an alternate UNIX-like proprietary software based on an IBM property. At issue here is whether the world ends up paying license fees for a proprietary operating system or shares near free access to "public domain" UNIX-like operating systems.

## II. THE ECONOMICS OF INTELLECTUAL PROPERTY RIGHTS

Economists think about the production, distribution and use of goods and services in terms of three basic types of efficiency. They are technical efficiency, allocative efficiency and dynamic efficiency. Technical efficiency is straight forward, involving the optimal mix of inputs to produce output. The supposed short term gains from the Mulroney Trade Deal with the United States are based on a technical efficiency argument. Canada is to experience lower costs from longer more specialized production runs. Allocative efficiency deals with society's choice of that basket of goods and services which maximizes some objective social function. Western economies use market forces to achieve allocative efficiency. In theory, goods are produced in competitive markets to the point where the value of the last unit produced is equal to the marginal cost of producing it. This is the so-called "marginal pricing rule".

The last efficiency, dynamic efficiency, refers to the pace and direction of technical innovation in a society. Policy directed at allocative efficiency and policy directed at dynamic efficiency are frequently in conflict. Two recent Canadian cases illustrate the point. Until recently Canadian law regarding the patent rights of pharmaceutical companies favored allocative over dynamic efficiency. Firms were required to license generic production of brand name drugs. This encouraged production levels and price competition with output based on price and the marginal cost of production. Current Federal government has strengthened the patent rights in exchange for a promise of more research and development in the future. This is a case of social policy support for the promise of dynamic efficiency over the actual gains of allocative efficiency.

The second and more ominous case involves the impending intellectual property bill, popularly known as the copywrite bill. It spent considerable time bottled up in the Canadian Senate as a result of intensive lobbying by Canadian universities and library systems. At issue are the economic rights of those who create intellectual property and terms of access to such properties. Properties range from the ownership of a song, sheet music, a computer programme or encoded chip, to the printed page. Technologies ranging from photocopy machines and audio/video recorders, through to the computer disk and chip, coupled with optical fibers and satellite communications, have reduced the marginal cost of reproduction, transmission and distribution of information to virtually zero. Allocative efficiency suggests that access to photocopies, songs, computer programmes, etc. should be available at almost zero cost.

There are, however, two societal arguments in favour of higher cost access to "intellectual properties". One has to do with equity. Many of those who create "cultural" properties receive rewards for success that fall well short of the value of their product to society. There is support for intellectual property rights that improve the economic status of those artists and writers who "produce" cultural properties. In light of the allocative efficiency arguments, it is not clear that solutions involving unit price approaches are the best. This is part of the argument mounted by universities and libraries in opposition to the intellectual property bill currently before Parliament this year.

There is a second argument, more closely allied to "dynamic efficiency" which argues that adequate rewards, as in the case of exclusive pharmaceutical patents, are necessary to promote the continued flow of intellectual properties. While there can be little argument about the desirability of a continued production of knowledge (intellectual property), there should be serious debate about the proper way to promote it. Western culture has a long tradition of producing and distributing a major share of its intellectual property via public institutions, the most noteworthy being the institutions of public education. Public support has been justified on several grounds. The high fixed cost of development and low marginal cost of supplying knowledge suggest that the supply and use of intellectual properties would be sub-optimal if left to private market forces. There is an equity argument here as well. Public support for education offers opportunities for social mobility essential to the legitimacy of democratic society. It provides a correction to those inequalities that so worry John Rawls, in his well known **Theory of Justice**.

There are strong forces of self interest supporting a modern "enclosure movement" in which intellectual properties become private properties. As intellectual properties become increasingly important in the production process, monopolistic control of intellectual effort carries with it monopolistic profits. The Apple Computer Company and Lotus 123 "look and feel" lawsuits against the Microsoft Company and the marketers of VP Planner Software are based on the argument that one company's software has the "look and feel" of the software of another company. It is as though Henry Ford were to sue Oldsmobile because the steering wheel, gas pedal and door knobs were similarly placed.

Policy movement on issues such as "plant breeders rights" and the recent Harvard University patent on a mouse are signposts on the road to the privatization of intellectual properties. The increased tendency of Canadian governments to provide weather and statistical information on cost-recovery terms, or to supply information gathered at public to "value added" retailers for resale to Canadian users are both moves in this direction. The pressure for universities to gain financial benefit from on-campus research, understandable in light of financial constraints, in the long run, will undercut the very mandate of the university and reduce its claim to a special public role in society.

From an economic perspective the concentrated forces behind an intellectual property enclosure movement are as understandable as were the forces behind the original enclosure movements in western Europe. The end result of this "enclosure movement" will be a major increase in the privatization of the production and use of intellectual property. In the process, the role of the university will be diminished. In the long run both allocative and dynamic efficiency will suffer at the hands of an increasingly concentrated control over intellectual property.

## III. INFORMATION TECHNOLOGIES AND THE RIGHTS OF CANADIANS

An unexplored issue surrounding emergent information technologies is their consequences on the exercise of individual rights. For, example, Meech Lake guarantees Quebec the right to protect its "distinct society". Do the Quebec language police have the right to close down a computer network operating in English in the Province of Quebec? At the national level, are "newsgroup" based conferencing systems (as found across UNIX installations) operating within and beyond the boundaries of Canada subject to the rules and regulations that govern "common carriers"? Are they subject to the rules and regulations that protect and regulate the "press"? Are the liabilities of the "sysop" who supervises an electronic bulletin board or conferencing area the same as those of the editor or the publisher of a magazine or newspaper?*

These are not hypothetical questions. They are issues driven by technology. The societal responses may differ from culture to culture. Much of the debate on the relationship between emerging electronic technologies and individual rights has focused on the right of the individual to privacy. It has concerned itself with the potential for massive databases of personal records to be used to invade the privacy of the individual. To the extent that there is a threat there it pales in significance when compared with the relationship between the emerging technologies and "freedom of speech" rights.

In late January of 1988, the U.S. Government Office of Technological Assessment published a report entitled "The Future of the Press and the First Amendment". New technologies are blurring the legal and regulatory distinctions between common carriers and the press. The question this raised for the U.S. Office of Technology Assessment was what constitutional rights are enjoyed by whom in these new technologies. In Canada the question is how do these technologies fare under the Canadian Charter of Rights. Observing, for example that computer bulletin board systems can be considered "many-to-many" news channels with no identifiable publisher to be held to account, the OTA report writes:

> *"[T]he First Amendment will have to be reinterpreted in response to almost certain challenges of the government's right to regulate access to the media and ownership of new media outlets."*

As well as suggesting to abridge the right to engage in freedom of expression using emergent electronic media, the report suggests that freedom of speech and of the press may be further curbed to prevent the involuntary transfer of technology to hostile nations.

There are dangerous political and economic arguments for controlling the emerging electronic technologies. Unregulated E-mail conferencing has the potential to be viewed as unlawful assembly in certain situations. It may be regulated or suppressed by governments. The U.S. government worries about "the involuntary transfer of sensitive technology to potentially hostile nations". The OTA report extends national security beyond protection by weapons to protection of technological innovations and industrial competitiveness. This extension of the definition of national security is reflected in the U.S. National Security Council's National Security Decision Directive (NSDD) 145 which creates a new classification titled "sensitive but unclassified".

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* Remote access raises moral and ethical questions. During a university strike a student who refuses to cross the picket line routinely logs on to the campus mainframe, downloading assignments and uploading answers. Does this constitute crossing the picket line?

The U. S. experience is instructive. At the federal level the government is trying to close in on electronic communications, proposing economic, political and national security rationales for regulation.* At the state level forces are attempting to shore up freedom of speech "First Amendment Rights" in the electronic age. Bill ACA-36 before the California legislature is designed to protect "freedom of electronic speech" with a "right to electronically communicate on all subjects". It would provide that "a law may not restrain or abridge liberty of electronic communications and that rights against unreasonable search and seizures extend to personal information stored in electronic information systems and computer databases.

The U.S. experience is instructive not so much for its details. They are shaped by the U.S. approach to individual rights and freedoms. What is important are the substantive issues. Is a distributed system of linked databases nothing more than a community discussion with a reference library? Is it an electronic newsletter subject to "freedom of the press" guarantees and controls? Is a "network" subject to CRTC licensing? It is useful to recall that the inventors of FM-radio foresaw it as the basis for a minimally regulated network of low power community radio stations. It became something quite different.

In the short run it is hard to say where the struggle over the control of new electronic medial will go. It is clear that a decade ago few expected "Electronic Rights" to be contending for a spot on the political agenda of Canada. Even today there are few who would examine the Charter of Rights, the Meech Lake Accord or the Mulroney Trade Deal as they affect the role of the electronic media in Canadian society. Even the Senate debate over the copywrite bill has only begun to scratch the surface on these issues.

In conclusion, much has been made elsewhere of the promise and problems associated with the emerging electronic revolution. The first part of this paper on PICKnet uses and the companion piece on computer supported interactive distance education (CSIDE) explore computer uses for a "Copernican Revolution" that will sweep formal and popular education. The focus is on the promise in the technology. The main part of this paper focused on contentious issues that constitute the dark side of the new technologies. They are much more subtle and more dangerous than the "invasion of privacy" fears that are routinely cited as the "dark side" of the new technologies.

All of the forces on the dark side are likely to have a major impact on universities, and will likely threaten the place of the university in society. Areas of particular concern dealt with the potential for a damaging "intellectual property enclosure movement" and threats to individual freedom of expression and communication. However, in this brief presentation we have time only to scratch the surface of the issues dealt with. It is my hope that universities turn attention to the issues raised here before the forces at play do irreparable damage to universities and society.

# Teaching Information Design

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Since the mid-eighties, many major university-level Fine Art departments have been using computers to help students to create images. This is, from the art student's standpoint, a great idea so long as the cost of such equipment isn't borne by the student. From an instructor's standpoint there is little to be gained educationally by using computer imaging. At best, the computer in the hands of an undergraduate can do certain things real paint and canvas can't. At worst the computer becomes another unwanted distraction from the learning of aesthetics, design and visual meaning. After some study we decided to turn from the trend of costly computer imaging to adopt a less expensive multi-image approach. This paper is an account of our experiences and observations.

We decided to employ microcomputer-based course authoring software to teach *interactive* computer art where the viewer of the work becomes an active participant. Because it is not solely visually-based but has elements of text and animation (time), this course also had the advantage of being useful to other Humanities students, particularly those in the more 'creative' or open-ended disciplines.

*Information Design* is an interdisciplinary course offered by the Fine Art Department at the University of Guelph. Its two main objectives are to:

1) *use computers to give life to ideas*
   and
2) *allow students to experience hypertext and hypermedia*

The semester credit course is open to advanced Fine Art, English, History, Philosophy and Computer and Information Science undergraduate students. *Information Design* presents visual, textual and contextual problems in a hands-on computer workshop setting.

*From "Star Trek Adventure Game" by Doug Schaefer*

In the first offering of the course in 1987, students used a "traditional" course authoring program called VITAL to create an interactive, multi-path version of the story of the "Three Little Pigs." Owl International's *Guide* for the Macintosh was also experimented with informally. Lab time was supplemented by a series of readings and discussions on hypertext (including Vannevar Bush's "As We May Think").

When Apple's HyperCard for the Macintosh (which allows for the incorporation of text, graphics, sound through associative linking) was introduced, the course was redesigned, and as a result a more acceptable fit to the learning objectives was made possible using HyperCard.

## Course Format

*When you begin to dream about it, you're internalizing it*

Because this is still a course in development, funding could not come from the regular Fine Art Department budget. The University's Department of Continuing Education supports a number of 6-week semester-credit courses in the summertime for students who wish to get a credit in half the time. There are advantages and disadvantages to this approach. The intensity of the program allows for better reinforcement of the material learned. This is offset by the fact that there is less time for students to work out-of-class, and that a week-long absence due to illness results in a much higher catch-up penalty. Fortunately, the Macintosh Lab was available most days, and no one got really sick.

The Department of Computing and Information Science let us use their Macintosh lab, which consisted of 5 Macintosh Pluses linked through AppleTalk to a Mac Plus/20 megabyte hard disk server running MacServe. Because the Macs had no external drives, we had to partition the MacServe machine and place 5 copies of HyperCard with the Help stacks in each partition. Each student would then have to boot and run their computer with a disk holding a pared-down system and Home stack. This arrangement, while far from ideal, worked surprisingly well and ensured at least 500K free on disk for student work.

The 5 Macs which were available allowed us to accept only 10 students, as opposed to the regular 30 students admitted to a typical Fine Art studio course. I think an ideal situation would be 20 students using 20 computers. I spent most of the class time watching the students interact with the computers, lending a helping hand only when they were 'stuck'. It's been my experience (and perhaps it has something to do with my teaching style) that ten students, unless they are very bright and/or enthusiastic, rarely provide the necessary dynamic for exciting instruction. I think that twenty students would have reached *critical mass* much sooner.

The class was composed of 9 females and 1 male. All were at least at third-year level; two were mature part-time students, and two were 'Visa' students from Hong Kong.

Classes took place Monday through Thursday evenings 6-9pm for six weeks.

## Course Outline

*The Search*

Students were required to document their search for sources of such difficult-to-locate items such as padouk, gold thread, potter's wheel and mandarin oranges. The purpose of this exercise was to illustrate the different 'media' used in the search (face-to-face, telephone, reference books, libraries etc.). Their documentation was to take two forms:

1) a linear, step-by-step listing of who or what was consulted, when the consultation took place, and what was learned by the consultation.

2) a flowchart showing the same information graphically, but using lines to link one consultation box to the next. This format is better at illustrating how a search progresses, and can show the results of a search—the dead ends, the successful conclusions.

At the end of this exercise, students are aware of the differences between the presentation of linear information and the presentation of information blocks linked to-

gether by association. This contrast provides and excellent launch into the subject of hypertext and hypermedia.

*HyperTalk*

The next few days introduced *HyperTalk*, HyperCard's object-oriented programming language.

As a mini-exercise, students were required to create a working Address Stack, similar to the the one made available by Apple with HyperCard. Participants learned how to create new cards, buttons and fields, and how to link cards together with the link function within each button. Many students 'went overboard' with the painting tools, though later on simplicity and sparseness were encouraged. As part of their stack, they created a special 'bugs' card for listing programming and organizational errors.

The students took active part in the evaluation of the Address Stacks by passing around their discs to other members of the class for comments (on the 'bugs' card).

*Once Upon A Time...*

In the first iteration of this course in 1987, students adapted *The Three Little Pigs*. I thought it would be appropriate this time to do *Goldilocks and the Three Bears*. Using an old familiar story to demonstrate a new way to communicate is appealing to me; perhaps because it develops while it repeats makes it particularly suited to a first try at hypermedia. Or it could be the subliminal richness of the Goldilocks experience?

The requirements of this project are straightforward: create a HyperCard stack which conveys the Goldilocks story using pictures, words, sound and animation. It must be interactive—the viewer/participant's reactions must be able to change his/her path through the story. The students were encouraged, but not coerced, into making a graphical flowchart on paper before starting on the computer.

*"Goldilocks and the Three Bears" by Lana Derochie and Janet dal Bianco: In this stack, participants must be able to find their way through other fairy tales.*

**Observations**

*"With HyperCard we have designers writing programs and programmers building rock videos."*[1]

There have been many collegial discussions about the appropriateness of Fine Art studio instruction in a university setting. Some feel, with some justification, that the teaching of visual art skills should not be supported by institutions concerned with scholarly research and education, that community or technical arts colleges should be responsible for this area. Perhaps the only reason creative Fine Art has survived in higher education is its important place in the traditional liberal arts curriculum.

Studio instructors are probably the first to admit that not only is their subject matter unusual for a university, so are Fine Art students. The typical Fine Art student is less literate and numerate, and less inclined to 'scholarly' study. On the other hand, they are more creative, open and playful with ideas of all kinds. They tend to be generalists with global views and concerns.

Until hypertext and hypermedia software became available, the activity of programming was limited to those individuals who could organize their ideas in a structured manner. Computer scientists refer to 'top-down' programming; breaking down a problem into smaller and smaller pieces until each piece consists of a line of code. Computer literacy was equated with the ability to program in BASIC or PASCAL. Moreover, these systems were text-based, due to the inability of many computers to handle graphics.

The result was a situation where, like non-artists telling artists "Oh, I can't draw", the artists were telling the programmers "Oh, I can't program."

### Hard and Soft Mastery

In her book *The Second Self*, Sherry Turkle tells us about two children, Jeff and Kevin, who set about to individually program a space-shuttle program on the school's microcomputers. Jeff is good with machines and is able to impose his will upon the computer by employing the 'top-down' approach to programming. He 'becomes' the graphic elements on the screen which he has programmed.

Kevin is a counterpoint to Jeff. "Kevin is dreamy and impressionistic. Where Jeff tends to try to impose his ideas on other children, Kevin's warmth, easygoing nature, and interest in others make him popular."[3] Kevin's approach is tentative, experimental, and he can get sidetracked by a new graphic effect on the screen. He allows the computer to interact with his ideas. A boy-machine synthesis emerges. And where Jeff 'becomes' the graphic sprite on the screen, Kevin identifies with the *representation* of the astronaut on the computer screen; he romanticizes.

Turkle then presents us with the concept of two modes or styles of mastery, as illustrated by Jeff and Kevin; hard mastery is "the imposition of will over the machine through the implementation of a plan"[4] (Jeff). Soft mastery "is the mastery of the artist: try this, wait for a response, try something else..."[5] (Kevin).

### Reductive and Projective Paradigms

As I indicated at the start of this paper, the primary objective of the the Information Design course is to *use computers to give life to ideas*. This statement presupposes that computers can indeed *represent* ideas. The hard master is able to reduce the world into black or white through abstraction. The computer is considered as a formalized representation, reduced to the interaction of constants, variables and graphical computations. This relationship to the computer is *reductive*. In the reductive paradigm, computers may give life to ideas, but those ideas are limited to the abstractions of the program listing.[6]

On the other hand, the soft master tends to identify not with the nuts and bolts of the program itself, but with the expression or projection of larger suggestions emanating from the computer. We may call this relationship to the computer *projective*. In this paradigm, the computer becomes an interactive entity at a level equal to that of the programmer or participant, and as such it can be used to represent *any* idea or con-

cept. When the computer projects its simulated intelligence, we interact with it as with any other person, and carry within that dialogue aesthetic and cultural concerns.[7]

In Figure 1 I have presented a loose comparison of three creative activities using computers: Programming in BASIC, Computer Imaging, and the Goldilocks Project.

| COMPARISON OF HARD AND SOFT MASTERY ACTIVITIES | | |
|---|---|---|
| ACTIVITY | MASTERY TYPE | ENTITY RELATIONSHIP |
| Programming in BASIC | Hard | Reductive |
| Computer Imaging | Soft | Projective |
| Goldilocks Project | Hard/Soft | Projective |

*Figure 1.*

Of the three, only the Goldilocks project provides a crossover between hard and soft mastery. BASIC is a programming language that demands an organized overview of the problem at hand. Interaction with a paint program, however, requires no real programming—it is a simulation. Visual data is added, subtracted and processed using the ready-made tools provided by the software. It is visually projective, and truly effective only when approached using soft mastery techniques.

HyperCard, unlike the other two software methods, combines both hard and soft mastery styles; in the Goldilocks project, simple associative links can be done easily without programming. If bells and whistles are desired, that can be done at a later date with HyperTalk. One student who had programmed before attacked the project as a programmer would, by meticulously working out linking details while the other created the graphic content.

Once finished, the students were astounded at the amount of work they had done. Most groups (of two) had completed at least 50 cards, many of those cards having multiple links.

### Computer As Instructor

With the HyperCard software, the computer does the teaching. In such an interactive environment, if something doesn't work the first time, the student knows that probably spelling is the culprit. If it isn't spelling, it's syntax. The students quickly grasped the 'rules of the game:' to push the system as far as they desired. If it worked, it was 'legal,' as long as you spelled it correctly.

The human instructor would throw ideas out when needed; a repeat structure here, or a new button there. The hardest part was getting the students' attention when it was time to close down the Lab.

## Conclusion

Most of the students who enrolled in the Information Design course had little if any experience with computers. All had some Fine Art training, but for the most part they had little background in designing for a medium which combines pictures with animation, text and sound. They learned that designing information is as much a dialogue with the medium as it is with themselves. The hypermedia system acts as a mirror, reflecting the characters of the individuals who work with it.

The students made some interesting observations. After having viewed work from the previous years' class (which used the course authoring system that used colour but not sound), they concluded that sound was more important to have than colour.

The lack of resolution of the paint tools in HyperCard, compared to real paint, was not considered a handicap. For some it was a benefit, and helped them to focus on the what was necessary in the image.

In this course hypermedia is used to bring Fine Art students to the realization that the concepts of design are global; that these concepts can and should be applied to all creative expressions, regardless of medium. For students in the more "scholarly" areas of higher education, it is used to emphasize that all information must be designed if it is to be comprehended. For every student, it is a forever-patient interactive agent ready at any time to test new ideas about themselves and the world they live in.

## References


1. Chris Espinosa, quoted in *HyperCard Power: Techniques and Scripts*, by Carol Kaehler (New York: Addison-Wesley, 1988), p. 264.
2. Sherry Turkle, *The Second Self* (New York: Simon and Schuster, 1984), pp. 101-110.
3. Turkle, *The Second Self*, p.101.
4. Turkle, *The Second Self*, p.104.
5. Turkle, *The Second Self*, p.108. Going further, Turkle finds that there is a correlation between gender and master types: girls tend to be soft masters, while hard masters are almost exclusively male. I also find it interesting that programming books which stress soft mastery methods (type in this code, see what happens... change the code, see what changes) are sometimes referred to as *cookbooks*.
6. Douglas Adams, *The Hitchhiker's Guide to the Galaxy*. Adams tells of a supercomputer called Deep Thought, which, when asked the meaning of "life, the universe, and everything," answers "Forty-two." This quip is a perfect example of reductive identification.
7. Isaac Asimov is quoted as saying that "Any sufficiently developed technology is indistinguishable from magic." To paraphrase, if you consider the computer as a projective device, the content carried *on* it becomes independent *from* it. The 'message becomes the medium' in hypermedia.


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# Multi-Media Computer Projection System for Classrooms

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## INTRODUCTION

At one time or another every teacher has wished for the quality of colour slides with the flexibility of overhead projections without prohibitive expense. With modern technology, the possibility of projecting electronic overheads, computer simulations, and videotapes on the same machine during the same teaching session is a reality.

The lecture or seminar still requires thoughtful preparation, but the flexibility of random access to visuals allows the instructor to respond to the mood of the audience and clarify difficult concepts by utilizing the appropriate images.

The move to Multi Media Projection in the Department of Land Resource Science was simplified by the technical help provided by the Office of Educational Practice, and by the fact that much of the course material was already being used in other formats. Computer graphics, simulation programs and videotapes have been used for teaching purposes within the department for several years by several lecturers.

## EQUIPMENT

On the market, there are, or soon will be several sophisticated methods of randomly accessing a variety of visual images. Most of these methods (such as VISION) make use of the interactive video laser disk, but at the present time they have two major drawbacks. The first and major problem is the impossibility of routinely writing material to a laser disk. This seriously limits its use in the classroom, especially in advanced subject areas where material must be custom designed by the instructor. A second drawback to laser disk technology is the high equipment cost. For these reasons we have chosen to make use of low cost and surplus equipment to assemble a system that although not elegant, has proven to be extremely useful in our department.

The main components of the Multi Media Classroom Projection System are:

- An original IBM transportable computer with
  - two 360K disk drives
  - 512K RAM
  - enhanced graphics card (PCD6)
- Sony colour video projector
- Panasonic AG-1210 VHS video cassette recorder
- Norpak Mark IV Videotex decoder
- Video interfacee between the computer screen jack and the projector
- Sony high resolution analog colour monitor

All of these components are mounted on a home made cabinet on wheels, allowing easy transport between classrooms within one building (Fig. 1). These pieces are linked, through two sequential switch boxes allowing access to all possible modes of projection at the twist of one or two knobs (Fig. 2). There are essentially five main modes in which material can be viewed using this unit.

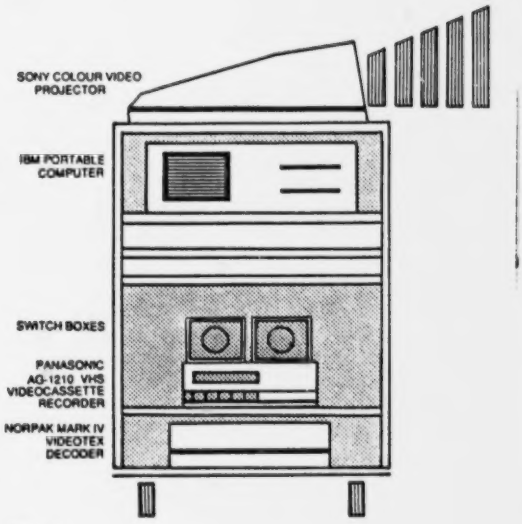


Fig. 1

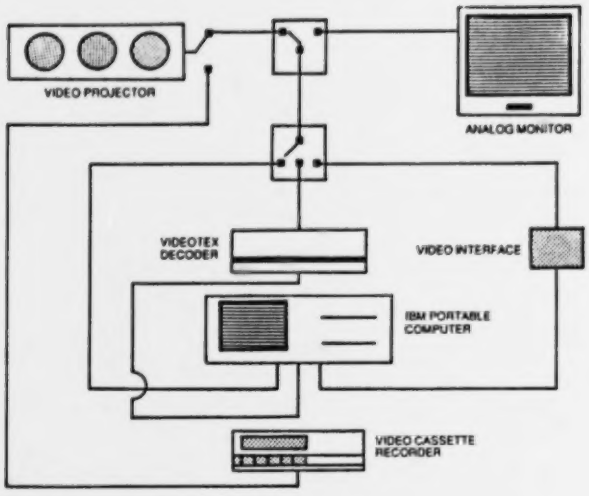


Fig. 2

## MODES OF PRESENTATION

The first type of display is Videotex graphics (NAPLPS) directly from a floppy diskette, through the VITAL-S software decoder, to the graphics card and on to the projector. This type of projection is at a fixed baud rate of 9600, the advantage being an almost instantaneous display of the material. A disadvantage of the fast display is that any built in animated sequences are lost.

In order to retain the slow motion and inbuilt simple animation necessary to fully understand some diagrams, a hardware decoder (Norpak Mk IV) can be used to display VITAL (Videotex) frames at a variable baud rate of 1200 or 2400. Slow display is also necessary during creation of the frames, to assure correct sequential appearance of the diagrammatic elements.

Experience has shown that in a lecture format the higher baud rate of 9600 is preferred by students, who are used to seeing images displayed quickly. This type of display is also routinely used in classrooms, because our system does not yet support multitasking, and switching from the fast software decoder to the slow hardware decoder requires rebooting the system.

Videotapes can be readily interfaced with any other display mode by setting a switch on the projector itself. A typical example of a video overhead - projection link would be for the instructor to display a series of computer generated overheads explaining the processes of volcanism then switching to a narrated videotape of a real volcanic eruption. In this way the learning process is reinforced by combining static theoretical information with films showing real-life happenings.

The system can be switched from displaying VITAL frames (overheads) to displaying whatever is on the computer monitor screen by sending the screen signal through an RGB interface (transformer) to the projector. In this way material created with any computer program can be projected onto the large screen for group viewing. At the moment this requires exiting from one program and loading another. In the future this problem could be overcome with the use of new generation microcomputers and multitasking software. This type of display is particularly useful for demonstrating a specific piece of software (that is, communications, simulation) to a large group simultaneously. In one instance a teacher used the system to demonstrate the writing of simple basic programs to the entire class at once, while another instructor showed a computer simulation of the post glacial stages of the Great Lakes.

Of course anything that can be sent to the projector can also be sent to the high resolution monitor to generate a portable workstation. This setup has proven useful in generating and modifying VITAL frames and testing a presentation in a small viewing room.

## CONCLUSIONS

The Multi Media Classroom Projection system used at the University of Guelph in the Department of Land Resource Science has proven to be a valuable teaching and communication aid for many faculty and staff. Some of the main advantages of the system are, ease of use, flexibility, portability, modest cost and excellent reliability. No specific training is required to operate the system other than rudimentary typing skills and of course a knowledge of the software being used. Enormous flexibility is an asset both because the projector can be transformed into a workstation and because the lecturer can switch between each of the projection modes at will during classes or seminars.

The system is readily movable within one building and can be used to service any type of room from a large lecture theatre to a small teaching laboratory. Total cost of the component parts was small ($8,000.00 in 1986) mainly due to the surplus nature of the equipment. Reliability of the system has proven to be excellent to date, however any machine can malfunction from time to time, and a wise instructor should always come well prepared and armed with conventional overheads and chalk.

# Teaching Hundreds by the Scores: A Practical Solution for High Student/Teacher Ratio Situations

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At the University of Waterloo, the introductory course in Organizational Behavior (OB), originally intended for classes of 50 60 engineering students, has been inundated by students from other faculties. In addition, the size of the engineering component has approximately tripled. Consequently, one professor is currently required to handle as many as 300 to 400 students each term. To help him, four or five graduate-student teaching assistants (TA's) are assigned, but these are often students majoring in other disciplines who have taken only one or two OB courses. In addition, the TA's have often done their undergraduate work in languages other than English.

## PRIOR PROCEDURES

The usual way of handling this course has been for the professor to give threelectures per week to each of two classes of 150 to 200 students. On some occasions, lectures have been given to as many as 400 students at a time. In addition, students have been required to attend five TA-run tutorials during the term in groups of 40 to 50. In these tutorials, the students have typically been subdivided into groups of 5 to 7 people for a case study. While discussion within these groups has frequently been intense, these tutorials have often received a very poor rating by students. The full reason for these poor ratings is not clear but it seems likely that at least some of the TA,s have not been in a position to handle adequately hte full class discussion following the group reports. As well as these lecture and tutorial sessions, students have been requir ed to hand in five case-study assignments to be marked by the TA's and to count for a total of 15% of the final mark.

In the past, some instructors have prepared and sold extensive printed notes while others have adopted the philosophy that it is better not to provide printed notes lest the students rely on the notes and skip the lectures. In the same vein, instructors who provide notes, have sometimes been criticized for giving lectures which simply repeat what is in the text and the notes. A number of students have pointed out that they arequite able to read for themselves and therefore the notes render attendance at the lectures a waste of time. Of course, with anything more than about 40 students in a lecture it is esseially impossible to engage any reasonable proportion of theclass in dicussion.

## DECISION TO CHANGE

It has been recognized for some time that this conventional method of instructing students in Organizational Behavior leaves a great deal to be desire d, particularly because the nature of the subject calls for much student/teacher interaction. Therefore, on being challenged by my departmental chairman to find some better way, the writer* devised the following method, and has used it successfully for the past eight terms.

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* The challenge to develop this method and encouragement to implement it came from Professor M.J. Magazine, the chairman of the Management Sciences department. In developing this new method, much very useful discussion and advice was obtained from Professor Bill Sholinsky of the Teaching Resources group and from Ian Smart of the Engineering Counselling service.

## THE NEW PROCEDURE

The new approach is based on a class size of one to two score students meeting for one hour per week with the professor plus the use of scored qui each week to motivate the students to keep up-to-date with thre radings in text and notes. One hour per week interacting with the professor in groups of 20 to 40 is more effective than merely listening to lectures for 3 hours per week.

The quizzes consist of 10 to 15 multiple choice questions each with 4 to 6 answers, some, none, or all of which may be correct. To allow these to be marked by machine, the multiple-choe questions are converted to true-false questions so that mark-sense cards can be used. The quiz then appears as 10 to 15 multiple-choice type of introductory statements each followed by several statement completions each of which the students are required to label as true, false, or "don't know". These are marked +2 for each correct
response, -1 for each incorrect response and zero for no response. The total of the eight or nine quizzes during the term is worth 10 percent of the final course mark. The quizzes are administered by TA's using foils an and an overhead projector. These are carefully timed, allowing 15 seconds per foil plus 15 seconds per question. The quiz therefore takes about 20 minutes to administer and is followed by an appropriate film.

In addition, the assignment load has been increased to six, the sixth assignment requiring the student to describe some organizational situation or sequence of events he/she has personally experienced and the relating of this to OB theories or techniques. This project or case-study form of assignment requires the student to think through the various OB theories and techniques and apply them to a real-life situation he/she has experienced. A number of the resulting stories have been used to advantage as case studies for turials, assignments and exams. Their use in tutorials and assignments gives students an additional insight into the views of other students.

Thus, the overall effect on the student is to reduce the required class hours from an average of 3.5 per week to 2.0 and to motivate him to read the notes and the text to be prepared for the weekly quizzes. Since the quizzes may include questions on tutorial discussions and on the non-compulsory films, they also motivate him to attend all sessions. For the first two weeks of the term, while students are still buying their texts and deciding on optional courses, the professor lectures to thewhole class. Quizzes start at the beginning of the third week as do the tutorials. The latter usually start with the professor showing appropriate transparencies from the current business press and newspapers, answering any questions and enlarging on the more important points. The class then breaks into groups of 3 to 5 people to discuss the case studies which were handed out at the previous week's quiz/film session. After the small-group discussion the students are very willing to participate in the instructor-led discussion with the whole group. This procedure has proven to be part icularly useful for developing those ideas which students traditionally have found difficult to grasp.

## RESULTS

From the professor's standpoint, it is much more satisfying to meet with eight or nine groups of up to 40 once per week than to meet with assemblies of 300 to 400 three times per week. The burden of the increased student-contact time is more than offset by the satisfaction resulting from the greatly increased opportunity for interaction.

An anonymous survey of students indicated 52% see this new method as an improvement over the conventional method while 29% see it as less desirable. Fifteen percent indicated no preference and 4 percent did not respond. The principal complaint from those disliking the new format was the weekly quizzes and the attendant need to keep up with the readings on their own. Many students, however, say they regard the quizzes as an essential factor in motivating them to keep up-to-date on the readings.

Since this is the first imprecise, non-technical, university-level course which many of the mathematics and engineering students have been reqired to take, it is not surprising that some of them blame the different course format for the difficulties they experience. Another problem for a number of such students is that , like some of the TA's, Engllish is not their first language. While this language problem poses little difficulty in subject such as mathematics, it can be a very real hurdle in the study of Orgazational Behavior. As an instance, one student was completely confused by the expression "putter about" in a case study because, according to her abbreviated dictionary, "putter" was defined only as a type of golf club.

## FUTURE CONSIDERATIONS

While this scheme appears to be a real improvement over the previous one, it certainly is still far from ideal. In particular, one hour per week with the professor is too little, and classes of more than 20 are still undesirably large. However, given the number of students wishing (or required) to take the course and the limited number of professors available, the scheme described is a significant improvement over the more conventional approach.

# Articulation Project:
# Joint Venture Between Seneca College and Georges Vanier Secondary School

**Vicki Milligan**
Chair, Articulation, Seneca College of Applied Arts & Technology
and
**Deborah Gans**
Head, Articulation, Georges Vanier Secondary School

**ARTICULATION** is a planned process linking two or more educational systems to help students make a smooth transition from secondary school to community college without experiencing delay or duplication of learning.

The **purpose** of the Articulation Project initiated between Georges Vanier Secondary School and Seneca College in December 1987 is to enhance students' opportunities to complete high school, to continue on to community college and to obtain the necessary career skills to become successful contributing members of society. This unique Canadian attempt at the co-ordination of instruction between high school and community college has great potential for improving the quality of education for students. Once developed, this model will be extended to include other schools in North York and York Region.

There are **two essential aspects** to the articulation process. The first is to co-ordinate the curricula between the two institutions to ensure that it is cohesive and responsive to students' needs. Areas of duplication as well as situations where skills are lacking must be addressed. Provision for advanced standing college credit, preferred entry to specific college programs, or enrichment can be established once the relationship between programs is clarified.

Secondly, student knowledge of career options and college programs will increase through the articulation process. Improved communication between faculty at the two institutions results in a better awareness on the part of high school teachers of college programs and academic and skill requirements for students and on the part of the college faculty of high school students' abilities and expectations. High school teachers will be in a better position to guide and direct students toward specific college programs. College faculty and resources will be utilized to heighten student awareness through visits to high school classes and field trips to the college.

When students have a better focus on what they can do and how they can achieve it, education becomes more meaningful. This process will provide motivation for students to continue their education as they develop realistic career goals.

An **holistic approach** to articulation has resulted in identification of the critical skills (literacy, numeracy, and generic) required for students to succeed in specific college programs. There is then a matching process between these critical skills and the Grade 11 and 12 subjects which will best develop the skills. Some restructuring of curricula may be required. A package of courses is then recommended to students which if taken will grant them **preferred entry** to that specific college program.

As well, articulation involves a consideration of **competency based education** since it facilitates a mode of comparing curricula. These assessments are a precise means of outlining the specific skills to be achieved and monitoring student progress. Vanier teachers in consultation with their Seneca colleagues are working to develop lists of competencies upon which the students will be evaluated and which form the basis for recommendations for **advanced standing college credits**.

Where appropriate, students will be enrolled in an enriched college course designed to build on the skills already developed in previous high school courses. In this manner, students will graduate with a higher skill level in that particular subject area.

An **institutional articulation agreement** has been signed by the Director of the North York Board of Education and by the President of Seneca College of Applied Arts & Technololgy. As well, **six program articulation agreements** have been signed as follows:

- Electronics Engineering
- Mechanical/Manufacturing Engineering
- Civil/Resources Engineering
- Travel and Tourism
- Office Administration
- Day Care Assistant

Plans are underway to expand the model to include other existing programs at Seneca. As new college programs and high school courses are developed, articulation will be an important aspect of this development.

## CONCLUSION

Modification or development of new programs linking curricula which have more of a career focus at the high school level is an exciting new approach for education. Although the initial target group is the General Level, courses are being articulated for Basic and Advanced Level courses as well.

The establishment of a strong liaison between high school and community college facilitates an exchange of information and resources. As we work through the articulation process, positive opportunities continue to emerge for enhancing this relationship and improving education for students. Through the clarification of critical skills and the implementation of competency-based assessment, students will find education more coherent and relevant. With continued support and endorsement, the tremendous potential of articulation for educational excellence will be realized.

# Student Pseudo-journals as a Method for Achieving Cognitive Apprenticeship in Writing in the Social Sciences

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The focus of this paper is an issue that I have found to be particularly vexing, namely the quality of writing which university undergraduates produce for me in the courses I teach. Over the years I have come to accept that much of what students write for me is of low quality. Even where I might judge content to be adequate I have often had more or less serious concerns about the form of what has been written. I assume that I am not alone in this general impression about the quality of undergraduate writing. My earlier reactions ranged from blaming high schools and even elementary schools to assuming that today's students are simply not interested. To the extent that I felt I should do something, I felt limited by my own lack of knowledge about how to teach writing and by a serious lack of resources; after all, I reasoned, how much can I do about student writing in a course on the history of psychology? I therefore settled into muddling along. I considered myself to be primarily in the business of communicating the content of the course and marked papers and exams accordingly. I assigned papers and projects and read and commented on submissions suspecting all the while that my students read only the grade I assigned their papers, ignoring my other feedback. Over the last few years, however, I have become increasingly unhappy with this approach to university instruction, which I now take to be modal. This approach seems to me to be successful primarily at communicating bodies of knowledge. In contrast, I have long felt that we educators, and perhaps especially university undergraduate teachers, should focus our instructional efforts on process rather than on content.

This paper sketches out what I have done in the last few years and what I plan to do next year in order to address this problem. First and foremost, I have been concerned with finding ways of conceptualizing how my instructional effort should be allocated. For example, I explored the distinction between "learning" and "learning to learn" (e.g. Harlow, 1949), thinking that perhaps we should be teaching students how to "learn to learn". Similarly I have been inspired by the distinction between "expository mode" and "hypothetical mode" teaching (Bruner, 1961), feeling that we rely too much on expository mode lecturing. In the end, however, I have always come back to the notion of apprenticeship, rooted as it is for me in my successful experiences as an apprentice electrician and as a graduate student in psychology. It is the idea of apprenticeship, more than any other, that has served me in my thinking about undergraduate instruction. You can imagine my pleasure, then, when I came upon a chapter by Alan Collins, John Seely Brown and Susan Newman entitled **Cognitive apprenticeship: Teaching the craft of reading, writing, and mathematics** (in press). Most importantly then, I want to offer an unabashed advertisement for their article, which has offered me a fruitful way to conceptualize what I think I ought to be doing as an undergraduate instructor concerned with improving student writing, and I want to share it with you.

In addition, I want to tell you about three recent instructional innovations I have more or less been involved with in the psychology department at Brock university. My involvement in all of them was, more or less, aimed at addressing the question of how I could foster better writing in my students without turning my courses into courses on writing and forcing me to commit impossible amounts of my instructional time to the issue. Finally, I want to close this paper with a discussion of my plans for next year which involve combining some of the advantages of each of the three innovations mentioned above into an approach which I think has the potential to create a reasonable cognitive apprenticeship environment in Social Sciences courses without requiring an inordinate outlay of instructional resources.

## THE IDEA OF COGNITIVE APPRENTICESHIP

Collins, Brown and Newman, (in press) begin their paper by questioning the effectiveness of current instructional practice. They argue that "While schools have been relatively successful in organizing and conveying large bodies of conceptual and factual knowledge, standard pedagogical practices render key

aspects of expertise invisible to students. In particular, too little attention is paid to the processes that experts engage in to use or acquire knowledge in carrying out complex or realistic tasks" (p 2). Lacking in the relevant expertise - mostly processing skills - students' resulting knowledge is too "brittle" (not generalizable) and "inert" (not easily accessible when needed). They go on to suggest that the learning fostered through traditional apprenticeship may not be as vulnerable to these problems and identify two key features of apprenticeship learning which may contribute to more solid learning.

First, they point out that traditional apprenticeship focuses on learning methods of carrying out tasks in a domain. According to Lave (cited in Collins, Brown and Newman, in press), apprentices observe masters modelling the execution of a variety of domain specific tasks. One important outcome of these observations is that the apprentice develops a conceptual model of expert task performance. This model is successively refined over experience and serves as a basis for the development of self-monitoring and self-correction skills. Apprentices then attempt those tasks themselves with coaching from the master. A central component of successful coaching is "scaffolding": assistance the master provides which the apprentice requires in order to approximate the desired task performance. As the apprentice continues to practice the skill in question, the master gradually reduces the amount of assistance to the apprentice (i.e. "fades") until the apprentice is self-supporting.

The second key feature of apprenticeship is the social embeddedness of learning. That is, learning takes place in a "subculture in which most, if not all, members are visible participants in the target skills. As a result, learners have continual access to models of expertise-in-use against which to refine their understanding of complex skills... learners have the opportunity to observe other learners at varying degrees of skills; among other things, this encourages them to view learning as an incrementally staged process, while providing them with concrete benchmarks for their own progress" (p 4). Such a sub-culture, then, provides an intrinsic justification for the value of the skills in question and thus makes it much less likely that apprentices will wonder about why they are learning those skills.

Collins, Brown and Newman, (in press) propose that these two key features of traditional apprenticeship, a focus on expert processes and situated learning, can be extended to the teaching of subjects like reading, writing, and mathematics - something they refer to as "cognitive apprenticeship". In this context, they discuss the work of Palincsar and Brown (1984), on the reciprocal teaching of reading, Schonfield's (1985) work on teaching problem solving in mathematics, and Scardamalia and Bereiter's (1985) work on the procedural facilitation of writing.

## THE NORMAL COURSE OF UNIVERSITY WRITING

From the perspective afforded by Collins, Brown and Newman, (in press), then, the problems university undergraduates have when writing papers at university, at least in the social sciences (as opposed to, say, English), are twofold:

First, students do not have an adequate conceptual model of writing. According to Bereiter and Scardamalia (1987), novice writers follow a "knowledge telling" strategy, according to which they write the first idea they think of, and then the next one, until they run out of ideas, at which point the essay is finished. Alternately, novice writers may be seen as writing essays in a single draft (Bruce, Collins, Rubin, and Gentner, 1982). For some reason, many students have never internalized the complex of skills which comprise expert writing into an appropriate conceptual model (it is interesting, but beyond the scope of this paper, to explore why this may be the case). We university instructors often do not help because we usually either assume that students already know how to write or lament the fact that they can not. That is, we may not do enough to foster the development of an appropriate conceptual model of writing. Rather, we assign papers, assign grades, and comment on those papers. The student picks up the paper, checks out the grade, and goes on to the next assignment. Normally, only extremely poor writing is flagged for extra work, which is often delivered in the form of remedial writing instruction. Thus, the skill of writing is rarely dealt with explicitly; it is really invisible to the student. We professors, the experts, rarely model the skill of writing, preventing the student from developing an adequate conceptual model of good writing. Quite often, little coaching takes place. The usual student essay is a one-shot performance which does not normally provide adequate feedback for improvement. Finally, the only thing close to fading which takes place is that marking criteria may change from early assignments to later ones - a focus on product, not process. Second, the exercise of the skill of writing is rarely socially situated. Students assume that they are writing their papers for one person only, the instructor or marker. They usually do not enjoy any access to models of expertise-in-use unless they are fortunate enough to have a friend who is both a good writer and willing to let onlookers observe. Usually sharing is restricted to sharing the products of writing, not the processes. Indeed, the student usually writes papers alone, for a single reader, the professor (or marker), and rarely, if ever, has any opportunity to read papers written by other students. The only real source of models of

writing is to be found in the books and papers which the student is assigned to read - from the literature. Such highly polished products at best offer students a very distant goal towards which to aim with very little useful information about how to get there.

It is, of course, possible to offer many more or less defensible justifications for why this state of affairs has arisen, and why we teachers of undergraduates cannot be expected to turn all of our students into expert writers. While it is beyond the scope of this paper to survey them all, I wish to highlight one of the most important: resource limitations. We do expect supervisors of masters and doctoral candidates, and perhaps of honors students, to use apprenticeship methods to improve their students' writing, but we do not expect it of undergraduate instructors because they must teach far too many students to pull it off successfully. Further, we are expected to teach all those students about something besides writing - we are responsible for teaching about some content area. Focusing on writing skills, especially in an apprenticeship mode, is simply too resource intensive - we do not have the time, energy, or support resources to carry it off and achieve our main instructional goals.

In the remainder of this paper, I wish to discuss my interest in improving the writing of my students by discussing three instructional innovations I have been, more or less, involved with at Brock University over the past few years. I will then move on to discuss what I plan to do next year in my courses. Throughout, I will try to show how I see my work as attempting to improve undergraduate writing by appropriating some of the best features of the cognitive apprenticeship approach identified by Collins, Brown and Newman, (in press), without devoting inordinate amounts of resource to that end.

## BURP

The first, and most productive, innovation I will discuss involved the introduction of a student pseudo-journal which I named B.U.R.P. (Brock University Research Proceedings), after a suggestion by John Benjafield, a colleague at Brock. The context was PSYC 340, our third-year psychology methods course - the gateway to our honors program (my co-instructor in the course was Paul Tyson). Students in that course have always been required to prepare a number of research reports, in proper APA style, as part of their work. Also, the course has always provided an apprentice-like approach to learning experimental methodology. In the first term students work on group experimental projects - from conception, to design, execution and write-up. Each group is led by a faculty member who provides a model for the students to follow. In the second term, students go on to do their own projects. In the first term, several smaller write-ups of studies or experiments, complete with data, are also required. It is these first-term write-ups which I decided to handle differently (although I see no reason why this approach cannot also be applied to review-type integrative essays as well).

I told our students how academic writing proceeds for professors. I told them about how we often get comments on early drafts of our papers, how we then submit papers to journals and how those papers are sent out to other experts in the field for review. I told them about how journal editors make judgements about the acceptability of papers based on reviews and also told them of the idea that papers are often accepted with revision. I then told them that I would be the editor of their very own journal - BURP - and that they should consider themselves to be just like professors as they worked on their research reports. They were told that all reports must be submitted (by a deadline) in triplicate - with identifying information only on the cover page. My course assistant collected the papers, assigned manuscript numbers, tore the cover pages off two copies of each paper, and handed them out to two randomly selected classmates for review. Written reviews were mandatory and were due back within a short period of time. All students then got their projects back with three reviews - two by anonymous peers and one from the editor (mine), as well as a decision on the paper. All papers were either accepted or accepted with revision. Papers accepted with revision were not assigned a grade until re-submission. Students were expected to pay close attention to the reviewers' comments, especially those of the editor, in revising the paper. Resubmitted papers were judged partly in terms of how well those comments were followed in the resubmitted document. Papers accepted without revision were assigned a grade of 72 (B-) or higher and could be resubmitted, if desired. Needless to say, in light of the instructional intent of this scheme, the first-round acceptance rate was quite low. There was also no guarantee that re-submitted papers would get higher grades or that once-rejected papers would get 72 or higher upon re-submission. Due to temporal limitations, only one resubmission round was allowed for each project. In retrospect, I should also have made it clear that papers could be rejected without the possibilty of resubmission. This is because some of my more clever (if not wiser) students soon twigged to the fact that failing to hand in an adequate first paper only resulted in the requirement to re-submit. Therefore, they submitted truly inadequate first attempts, just to meet the submission deadline. Comments on these sorts of first attempts were almost impossible to make, and hence the point of the exercise had been defeated. Such inadequate first submissions should lead to outright rejection to prevent students escaping the need to undertake a serious attempt on their first submission.

I did not formally monitor this experiment but have several clear impressions of the outcome - mostly favorable. From the point of view of Collins, Brown and Newman, (in press), it is clear that BURP satisfied some of the key features of a cognitive apprenticeship in writing. Most importantly, BURP moved some distance toward situating my students' writing in a more meaningful social context. This made it easier for my students to appreciate why they were engaged in the task of writing up their reports. For example, one question I have often faced concerns why psychology papers should be in APA format. After having to review a number of other papers, students came to appreciate how deviations from a conventional format make reading much more difficult.

In general, having students review other students' papers was very successful. All student reviewers took their task quite seriously. I did not have to "edit" any reviews, to take out overly harsh comments, before handing the reviews out. Many students reported that they had never attempted a critical review of the form and content of a paper - especially a student paper. They felt that they now had a better idea of how to take a critical approach to earlier drafts of their own papers. Several poor writers who happened to review good papers spontaneously noted that they now were more aware of why they were getting lower grades for their own papers. Interestingly, several good writers who happened to review weak papers were equally enlightened and took renewed pride in their own work. Many student reviewers also developed greater sympathy for the job which professors face when they mark papers. I interpret these results as revealing how reviewing for BURP forced students out of their usual roles of "producers" of text into the relatively novel role of "critics" (Palincsar and Brown, 1984). This new perspective, in turn, lead many of my students to an awareness that their "one-draft" production-oriented model of writing may be incomplete.

Most students also reported that they had never paid quite such close attention to the professor's comments before. They were now forced to attend to the editor's and the reviewers' comments more closely in order to successfully re-write the paper. It was my impression that re-submitted papers were generally of higher quality than the first submission, both of this group and of comparable groups I have had under traditional circumstances. Some students noted that they paid closer attention to their writing because they had to keep in mind that other students were going to read their papers as well. It may have been the first time that some of these students actually tried to adopt a different perspective when they read their own papers. I suspect that these students were grappling with just what they could and could not assume their readers would know in a way which they never had to when it was the (supposedly) omnicient professor doing the marking. These students were becoming more aware of the need to worry about the form, as well as the content, of their writing, and were becoming aware of the idea that you can alternate between the roles of producer and critic across successive drafts of a paper. It was also my impression that students developed a clearer idea of why one might rewrite a paper several times before handing it in. I interpret these findings as revealing how my students were becoming aware that a multiple-draft approach to writing may be both important and feasible to undertake.

Administering BURP was not as resource intensive as I had first expected. My course assistant, Marie Davis, was quite able to assume the role of "Assistant Editor". She accepted submissions, kept track of who was reviewing what, and even marked all papers for formal and stylistic issues. Thus, although I was now reading most papers twice, I was freed to focus on content only and found that my marking time did not increase that much overall. I will confess that I also checked all reviews, which took up some additional time. Overall, I estimate that my marking effort increased by about 50%.

## THE BROCK JOURNAL OF PSYCHOLOGY

Just this year, some of our senior students were instrumental in creating a different student pseudo-journal. Phil Hetherington (the editor) and Patti Kovachik (the assistant editor) worked on it almost entirely without faculty assistance. A call for papers went out to all psychology students to submit papers they had already submitted for course credit and for which they had received good grades. Nine papers were selected from those submitted.

The Brock Journal of Psychology was conceptualized from the beginning as a relatively high quality publication. The students involved learned to do desktop publishing using a MacIntosh computer and an Apple Laserwriter. They used Microsoft Word 3.01 for the body of the journal and Pagemaker 2.0 for the title page. My own role was restricted to offering minor technical advice on the use of the programs. The resulting output was printed to yield 100 copies which were made available for sale for $5.00 each.

This innovation is quite different from my work with BURP of several years earlier. This work was entirely student-driven, it actually resulted in a publication for distribution, and finally, it did not rely on usual models of journal publishing (e.g. external review, acceptance with resubmission). The first two of these differences are, as I see it, great advantages while the third is a serious liability, from the point of

view which I am developing in this article. The student-driven nature of this project is quite important. At a minimum, some of our students got an insight into journal creation, which they could not otherwise get. More importantly, the student involvement encouraged student enthusiasm and participation. Publication in the Brock Journal of Psychology was definitely seen as desirable, and hence as rewarding. If the pseudo-journal is kept going (current plans are for 2 volumes per year), it has the potential to become more and more popular, and hence more desirable to publish in. Students wanted to publish in the Brock Journal of Psychology and wanted to show off their work to others. As such, the Brock Journal of Psychology definitely serves to highlight the social, communicative context of writing. A final advantage of this project is that it required very little investment of faculty time or departmental resource.

The great liability of this project is that it is really only open to the cream of our students. There is no good reason for most of our students to be overly motivated. Further, this format may not result in improved writing, as BURP was intended to do, beyond providing an additional incentive for already motivated students. With no editorial function beyond selecting papers for inclusion, none of the advantages of BURP are obtained.

## WRITING BY WORD-PROCESSOR

For several years now I have been requiring students in my two senior half-courses, the Psychology of Reading and the Psychology of Computers in Education, to create all of their papers and assignments with a word processor. I have been enabled to do this because Brock University invested funds in the development of a microcomputer facility which is open both for course booking and general student use. The facility offers both Macintosh and IBM-compatible microcomputers. The MacIntosh computers, in particular, have become quite popular with students who can gain access at a wide variety of times. Many of these students use MacWrite to do word-processing. I do not require students to use this facility if they have their own systems or access to some other system; it is there merely to ensure that everyone has access to a word processing system. There is no extra charge for access to the lab, although students must supply a floppy diskette of their own to save their work on.

At the beginning of each half-course, I use my first seminar period to take my students into the microlab and show them how to use MacWrite. It takes about an hour to get students comfortable enough to be able to get by. In about 6 half-courses, I have never had a student balk at this arrangement and find that most students go on to use the lab to do assignments for other courses as well. I have yet to hear anything but positive comments on this arrangement, either in person or through anonymous course-faculty evaluations which I conduct every year.

The last two times I have taught the Psychology of Computers in Education course, I have gone further and have made the use of computers as tools to foster writing a major topic. I have developed a framework for approaching this topic which I have presented elsewhere (Mitterer, 1985, 1986; Mitterer and Watson, 1985) based on the work of Bruce, Collins, Rubin, and Gentner (1982). In brief, what I do is to introduce students to several key ideas:

First, I demonstrate that the process of writing is a complex one which can be decomposed into three major subprocesses - idea generation, text generation, and text editing (see Figure 1). Idea generation is the first stage of writing in which ideas are discovered and manipulated into a plan for a composition. Text generation is the stage in which the ideas are expressed as words. This stage involves casting the ideas into a text structure at several levels: the level of the entire text, the paragraph, the sentence, and the word. Finally, the text editing stage involves revising the results of the earlier stages in order to make sure that the resulting text does, in fact, communicate its intended meaning. Editing also may be undertaken at several levels: the level of the entire text, the paragraph, the sentence, and the word.

Second, I claim that expert writers compose in many drafts. Early drafts are revised to clarify ideas and the overall organization of the text while later drafts are revised to change individual sentences and words. In other words, the expert writer separates out the various steps in producing well-structured text. According to Bruce et al. (1982, p.137), "Separating the various levels in producing text structure helps the writer in two ways: it simultaneously eases the number of constraints that must be satisfied at one time and it increases the probability of satisfying any particular constraint."

Finally, I point out that novice writers generally create one draft in which they simultaneously, and usually unsuccessfully, attempt to achieve all of their communicative goals. Bruce et al. (1982, p. 142) comment that " Much of the difficulty of writing stems from the large number of constraints that must be satisfied at the same time. In expressing an idea the writer must consider at least four structural levels:

overall text structure, paragraph structure, sentence structure, and word structure. Clearly, the attempt to coordinate all these requirements is a staggering job." I point out that one consequence of this difficulty is the tendency of the novice writer to "downslide"; to get pulled into lower and lower levels of the writing task while losing sight of higher level goals.

My students are uniformly happy about the lectures I give on this topic and seem to believe me when I differentiate between novice and expert models of writing. One of the major benefits of word processing for these students is, as this framework makes clear, obviously in the ease of revision. For both of these reasons, my students report that they write in more drafts than they used to. The combination of describing novice and expert writing and the use of word-processors provides a passable substitute to the modelling which characterizes cognitive apprenticeship. In addition, this approach is not resource intensive at all. I use one hour to introduce word-processing and another hour to characterize novice and expert writing. In return, I get essays which are easier to read, having been printed out on a good printer after having been polished somewhat better than they used to be.

## PUTTING BURP, THE BROCK JOURNAL OF PSYCHOLOGY AND WORD-PROCESSING TOGETHER

It is my current feeling that the three instructional innovations I have described are each, in different ways, small steps towards creating a cognitive apprenticeship in writing. I also suspect that a combination of these innovations would generate an approach to writing much more powerful than the sum of the parts. Thus, I would like, in this section, to present my plans for my senior Psychology courses next year. I expect to put in place a scheme with the following components:

1) Every student will be required to use a word processor to produce each assignment or paper. I would prefer that the program be one like Microsoft's Word 3.01, with built-in idea processing, spell checking and perhaps other goodies like a thesaurus. These tools will make it easier for my students, who also face resource limitations of their own, to more easily implement their newly developing expert model of writing, with its stress upon multiple drafts, and to alternate between the perspective of producer and critic. At Brock, this component costs me very little, since the lab is already in existence and is centrally administered. My students' questions are answered by lab staff, so I need only devote an initial seminar session to bring my students up to speed.

2) Upon entering my course, I will explicitly give my students the overview of the process of writing which I sketched out above, focusing as I do on novice and expert models of the writing process. I adopt this approach as a substitute for explicitly modelling expert writing. Again, I expect to devote about an hour at the beginning of a course to this topic.

3) The Brock Journal of Psychology will be used as the motivating pseudo-journal. I will run my course as I did when I used BURP, by having students submit all papers for acceptance into the Brock Journal of Psychology. I will apply to hire a course assistant who will double as my "assistant editor" - this person's responsibility would be to manage all of the details involved in the process as well as to review papers for form and style. The feedback from my course assistant and myself, which must be incorporated into subsequent re-submissions, is expected to serve some of the functions of coaching, or scaffolding, which are a part of the cognitive apprenticeship framework.

4) All students in my course must serve as reviewers. Every student would thus have two reviews to do for every paper or project involved. I would create the opportunity for at least one iteration of every paper or project to be possible. This is expected to reinforce the process perspective on writing I will have presented at the beginning of the course. It is also expected to broaden my students' appreciation of the goals of writing. Overall, I expect this to play a role in coaching my students to a more mature model of writing.

5) Finally, I hope to see the "best" papers published on a periodical basis in the Brock Journal of Psychology. In this way, I see myself as an assistant editor responsible for locating suitable manuscripts and forwarding them to the senior (student) editors. Of course, the papers which I forward will be the best to come out of my courses. I hope that final editorial work can again be handled by students but hope also to secure secretarial and other low-level support from the Psychology Department at Brock, to support the pseudo-journal department-wide. As I argued previously, I feel that such a high-quality and high-visibility publication makes the situated, social context of writing in the social sciences much more obvious.

In closing, I have argued that the cognitive apprenticeship approach of Collins, Brown and Newman, (in press) can be fruitfully applied to the problem of the quality of undergraduate writing. I have identified resource limitations as a major reason why we cannot simply apply that approach directly to improve writing in all of our undergraduate courses. I have discussed three instructional innovations which incorporate some of the features of the cognitive apprenticeship approach without requiring an inordinate outlay of instructional resources. Finally, I have presented my plans to combine these innovations in my senior courses next year. I hope to report on the success of my attempt in the near future.

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# Computer Mediated Communication

**Dr. G.A.B. Moore**
Department of Rural Extension Studies
University of Guelph

**COURSE OUTLINE:** 38-629 (2) W'88
**SPECIAL TOPICS:** Computer Mediated Communication

## DESCRIPTION

Computer Mediated Communication (CMC) represents the convergence of small group practice, telecommunications and computers into a new form of social communication. This course will examine the theory and practice associated with CMC under conditions of computer mediated communication.

**FACULTY:** Course Co-ordinator - Dr. Ab Moore

**Guest Faculty**

Dr. John Black, U. of G. Library
Dr. John Bryden, Arkelton Trust, Scotland
Dr. Maria Cioni, Consultant, Toronto
Dr. Tony Fuller, USRP&D, U. of G.
Dr. Elaine McCreary, RES, U. of G.
Dr. Harry Cummings, USRP&D, U.of G.
Dr. Wout van den Bor, Wageningen, Neth.
Ms. Madge Brochet, ICS, U. of G.
Dr. Chris Knapper, TRACE, U. of W.
Dr. Stuart Hunter, English, U. of G.

## COURSE MATERIALS

- Proceedings of the Second Symposium on Computer Conferencing, June 1-4, 1987, University of Guelph
- Selected Papers

## PURPOSE

This course will provide students with an opportunity to investigate the emerging area of computer mediated communication in terms of its definition, development, technical infrastructure, societal context, methods of application to a range of social concerns, adoption strategies and constraints. It will also provide students with the opportunity to participate in this study under conditions of computer mediated communication.

## TOPICS

1. Convergence of technologies and definition of computer mediated communication.
2. Telecommunications context and technical infrastructure.
3. Moderating CMC sessions.
4. CMC and Rural Development - Scotland.
5. CMC and inter-institutional communication - Indonesia.
6. CMC and education.
7. CMC and course delivery.
8. CMC and adult education.

## PRE-REQUISITES

- a matriculated graduate student or admissability as an unclassified student
- access to a computer terminal with modem capable of connecting to the university communication via phone, iNet or datapac. (Students on campus will be able to meet this condition through various terminal pools available.)

## FORMAT

An initial on-camous meeting will be held to introduce the course, meet resource staff, discuss the first topics and receive sign-on instructions and other technical briefing.

The major discussions in the course will be carried out via computer conferencing using the University of Guelph's CoSy system. Participants will be responsible for analyzing one conference topic for which a faculty resource person will serve as the content authority.

A second course meeting will be held at the end of the course for the purposes of review, consolidation and evaluation.

A written paper will be required as the final assignment for evaluation.

# KanjiCard 300 and KanjiBox

**Kazuko Nakajima and NorikoYokokura**
Department of East Asian Studies
University of Toronto

## Introduction

**KanjiCard 300** is educational software being developed at the East Asian Computer Lab, University of Toronto. It is specially designed for students of the Japanese language to learn the Chinese characters or "Kanji", which are currently used in the Japanese language as part of its writing system. This project is one of the activities of the Apple Innovation Centre for East Asian Languages which was established last February in the Department of East Asian Studies with generous grants from the Apple Canada Education Foundation. **KanjiCard 300** and **KanjiBox** have been developed through the use of HyperCard on the Macintosh microcomputer with other applications such as VideoWorks and Sound Wave. We started only a few months ago and so far have completed a pilot demonstration package. The objective of this software is to facilitate the teaching and learning of Kanji at the beginner's level. It is intended for use by instructors to give a presentation of Kanji in a classroom situation as well as by students as an individual study tool. We hope that the study of Kanji, which is notoriously laborious, time-consuming and heavily rote memory dependent, will be transformed into something enjoyable and efficient by using **KanjiCard 300**. It is also hypothesized that once a student learns the first three hundred basic Kanji with this approach, it would considerably accelerate learning the remaining Kanji. Knowledge of approximately 1,800 characters is necessary in order to acquire an advanced level of reading skill in the Japanese language.

## Kanji and the Japanese language

As you may know, Kanji, which literally means letters of the Han Dynasty (206 B.C - A.D.220) originated in China more than 3,500 years ago. It was around the sixth century when Kanji, along

with buddhism, were introduced to Japan. Since the Japanese did not have their own writing system, they naturally tried to adopt Kanji to transcribe their language. However, this process was not easy because both the phonological and grammatical structures of the two languages are drastically different. Just to give a few examples, Chinese is a non-inflectional language whereas Japanese is an inflectional language. Chinese is a mono-syllabic, tone language while Japanese is a multi-syllabic, pitch language. Because of these structural differences, the Japanese eventually developed their own phonetic alphabets, Hiragana and Katakana, on the basis of the Chinese characters in order to transcribe the inflectional part of a sentence. In addition, the adoption of Kanji by the Japanese resulted in multiple readings among which a user must discriminate depending on the context. Surprisingly, only a few Kanji were invented by the Japanese, but they took the initiative to reduce the number of Kanji required for education and printing and to simplify the shape of Kanji in a way quite diffrent from the Chinese. As a result, the writing system of contemporary Japan is often considered the most complicated in the world. Even the Japanese complain because it normally requires nine to twelve years, almost all their schooling, for Japanese children to develop an adequate knowledge of Kanji. Therefore, Kanji has constantly been the target of heated controversy among educated Japanese since western civilization was introduced to Japan. Some people have argued that Kanji should be abolished altogether from the Japanese language, and have proposed that Hiragana, Katakana or even Roman alphabets should be used instead. Recently, as the importance of Japan as a trade partner grows all over the world, the difficulty of learning Kanji is more acutely felt. Just imagine how long it takes for a non-Asian to learn about 2,000 Kanji and nearly 5,000 readings. (If you learn one Kanji a day, it will take you about five and a half years and that's only if you don't take Sundays off.) Some new ideas to expediate the learning of Kanji are needed in this area.

With the emergence of modern computer technology, which has already made a breakthrough in the processing of Kanji electronically, the value of Kanji as an efficient means of visual information processing is better appreciated. There are unique features of Kanji that should be positively identified: (1) the greater amount of information that an individual Kanji carries in comparison with a phonetic alphabet; (2) the adaptability and word generating power of Kanji that function as roots; (3) the high level of inferencing that Kanji allow the reader. That is to say, when a reader comes across a new word or a new Kanji, he can gather the approximate meaning from the part or parts of the Kanji whose meaning is already known to him.

## Kanji as Iconic Representation of Meaning

The following are some examples. Kanji are ideographic, in other words, an iconic representation of meaning. Some Kanji are pictographic representations of tangible objects.

**Pictographic**

月 Moon　日 Sun　山 Mountain　川 River　馬 Horse

What about abstract concepts? These can be represented two ways: The first is to represent symbolic meanings with signs.

**Symbolic**

一 One　二 Two　上 Up, above　下 Down, below

The second way is to combine two or more meaningful elements to produce a derived abstract meaning.

**Ideographic**

(木) 林 Tree Forest

(人) 囚 Person Prisoner

(女) (子) 好 Woman Child Good　姦 Noisy

(日) (月) 明 Sun Moon Bright

(火) 炎 Fire Flame

The majority of Kanji, almost 90%, are what we call Radical-Phonetic Kanji, in which a basic element known as a radical is used to indicate the general area of meaning of the Kanji, and a phonetic element is put with it to show its sound or reading. Examples are:

**Radical - Phonetic**

(言) (丁) 訂　　(金) (同) 銅

Word 'tei' Correction　　Metal 'doo' Copper

In many cases, more than one Kanji is used in combination as a compound. In other words, Kanji have a strong word generating power since they can be combined with other Kanji to create new words. When one comes across an unknown string of Kanji like the following, the meaning of an individual Kanji gives a hint, on the basis of which the reader can infer the approximate meaning. Examples are:

**Compound**

| 二月一日 | 休日 | 風力計 |
|---|---|---|
| two, months, first, day | rest, day | wind, force, measure |
| February 1 | Holiday | Anemometer |

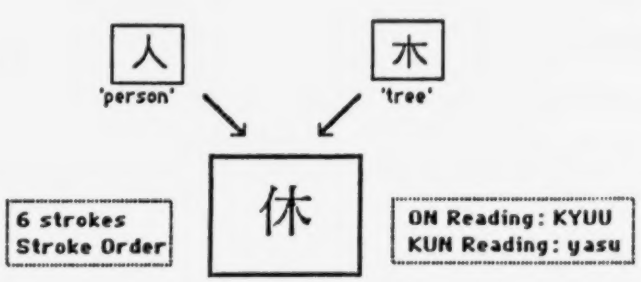
A Kanji can easily become a noun, an adjective or a verb just by adding appropriate endings in Hiragana. Examples are:

| Nouns | | Adjectives | | Verbs | |
|---|---|---|---|---|---|
| 休み | Holiday | 明るい | Bright | 休む | to rest |
| 好き | Liking | 姦しい | Noisy | 上がる | to climb up |

**Five Elements of Kanji Learning**

There are five basic elements that a student must learn for each Kanji.

1) Shape
2) Meaning
3) Reading
4) Writing
5) Usage



First, one must learn the generic **shape** of the Kanji. In many cases, a Kanji can be divided into smaller meaningful parts. The Kanji 休, for example (see above), can be divided into the RADICAL 亻 ('person') and 木 ('tree'). The Kanji has **meaning,** which is the semantic component. In this case, 'rest.' Some Kanji have more than one meaning (original meaning, extended meaning or borrowed meaning). The Kanji also has phonetic components, or **readings**. In many cases, each Kanji has two types of readings: one is the Chinese style or 'ON' reading and the other the Japanese style or 'KUN' reading. In this case, the ON reading is 'kyuu' and the KUN reading is "yasu'. In addition, the student must learn how to write the Kanji. He must learn its graphic components, the numbers, type, and order of brush strokes. This Kanji consists of 6 strokes. The student must also learn how to **use** the Kanji in a compound or a sentence. This is the morphological component. A few examples of the possible compounds and sentences using this Kanji follow:

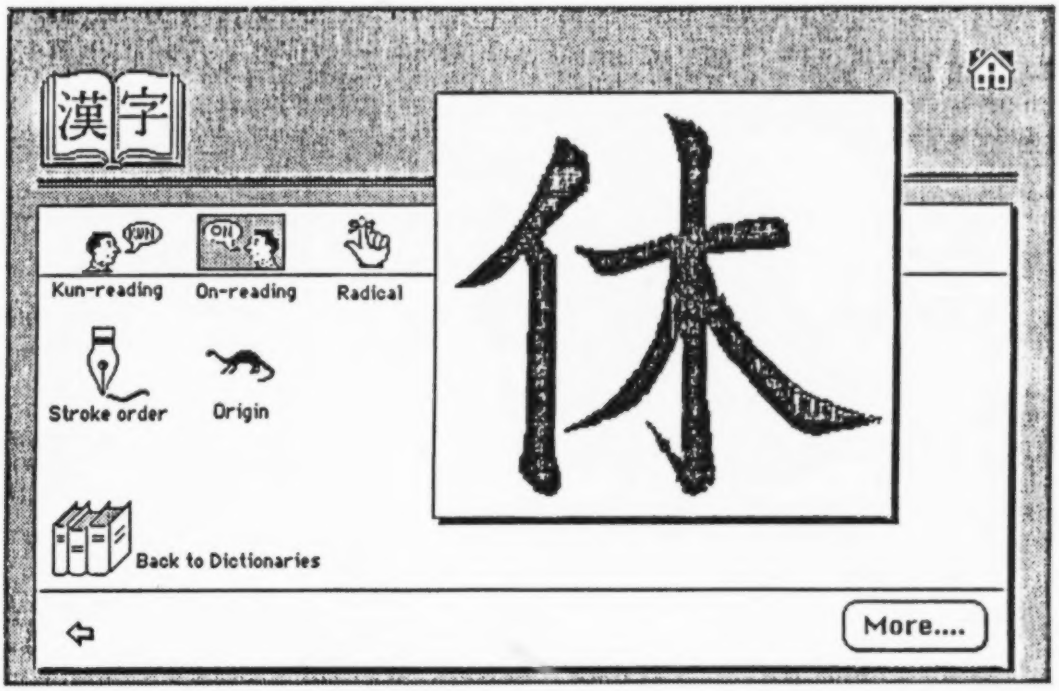
| | |
|---|---|
| 休日<br>'holiday' | 休みです。<br>'It is a holiday.' |
| 定休日<br>'regular day-off' | かぜで休んだ。<br>'He was absent because of a cold.' |
| 現在休業中<br>'currently out of job' | 今休んでいます。<br>'He is now resting.' |

**Outline of KanjiCard 300 and KanjiBox**

KanjiCard 300 allows a user, at his own selection, to have access to the following basic information about each Kanji.

1) The generic shape

Unlike any existing Kanji dictionaries or reference books, all Kanji will be presented in a clear, large image enabling students to see adequate detail.




2) The basic meaning with etymological and historical background

In most cases Kanji can be divided into smaller meaningful parts which help a student to understand the meaning of the Kanji. The understanding of these meaningful parts is emphasized because it assists the student to infer the approximate meaning of new Kanji. Computer-aided animation techniques are used to show the evolution of the Kanji while mininizing the textual description. For example, in KanjiCard 300 the figure below is shown changing into the Kanji 'to rest".

The Kanji character for "to rest" or "to take a break" consists of two components.

The radical to the left of the Kanji character symbolizes "a man".

And the component to the right of the character symbolizes "a tree".

Hence, the entire Kanji character means "a man resting under a tree" as this picture portrays.

3) The reading

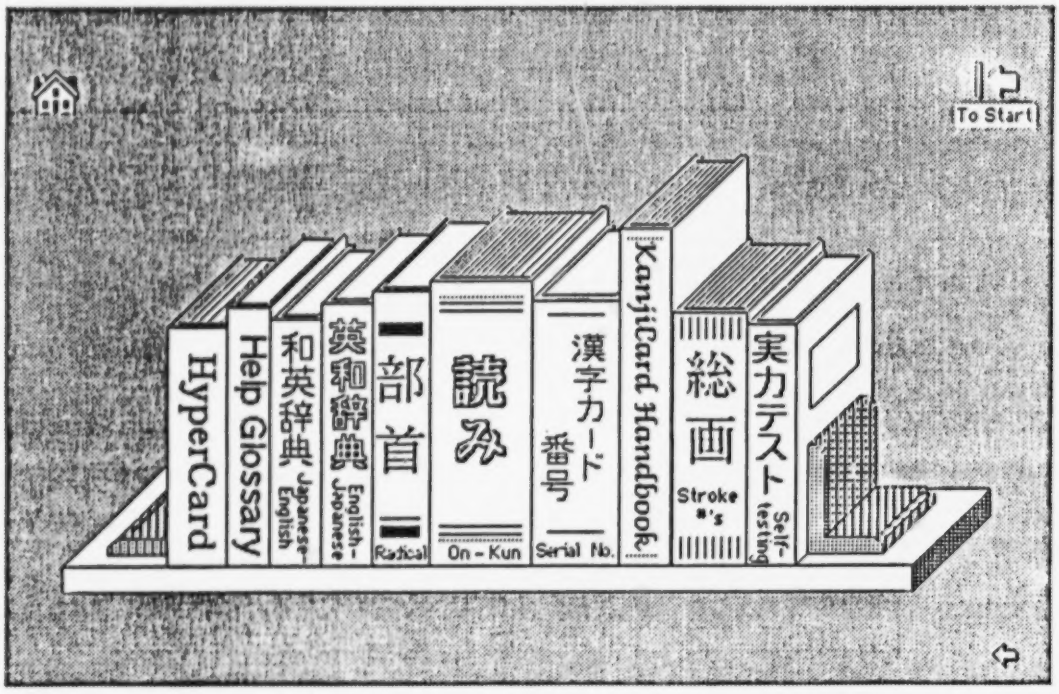
Each Kanji's readings are given by the digitized voice of a native speaker.

4) The number, order, and movement of brush strokes

These are presented using animation techniques.

5) The use of Kanji as roots in compounds and sentences

In addtion to these five basic elements and supplementary exercises for each Kanji, **KanjiCard 300** will include "Intrcduction" and "Help" functions. Several indices also facilitate quick access to the Kanji. These include the Phonetic Index, Radical Index, Stroke Number Index, and Vocabulary Index.




**KanjiBox** is an organizational tool designed through the use of HyperCard to customize **KanjiCard 300**. It consists of various ' boxes' by which a user can sort and collect Kanji that he or she is learning. An instructor can coordinate the use of **KanjiCard 300** with the reading text by

using **TextBox**, while keeping track of the number of Kanji and their readings that are presented to students by using **KanjiCalc**. Students are encouraged to use **AssociationBox** to share ideas with fellow students, so that the study of Kanji becomes more personal and enjoyable.

## Conclusion

Hypercard now enables us to coordinate graphic images, sound, movement and text, which is exactly what is needed to describe the wide range of information that an individual Kanji carries. We are confident that the **KanjiCard 300** can provide the learner with a far richer learning environment than any of the traditional instructional tools.

# Computer Based Image Editing for Design Instruction

**Maurice Nelischer**
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## INTRODUCTION

Design instruction depends greatly upon the use of visual images. While these images, usually 35mm slides, are useful documents, they are static complete pictures and may restrict in-depth analysis and understanding. By graphically, realistically and quickly manipulating photographic and video images, the instructor and student can visually explore design changes without using the time consuming abstract methods of architectural plans and perspectives.

Powerful inexpensive software and hardware has recently been developed to blend existing video and computer technologies. This marriage allows the student to work directly with a real image that has been digitized from a video tape.

During the design or sketch phase of a project as well as in the production of presentation-quality images, the speed and ease of this technique make it possible to readily test different designs to assess their visual impact.

## HOW IT WORKS

The original slide, photograph or video tape is put into the computer via any video recorder. This image is immediately digitized and the photograph-like quality image is displayed on the computer display screen in full colour. The quality of this captured image is what sets this technology far beyond that of any predecessors.

Once the image is captured it can be easily edited using a wide range of available "mouse" driven commands. Unlike other point programs this software allows the designer to choose any of 32,000 colours that are displayed on the original image. Thus by choosing the colour, tones, and brush width the user can draw on the original. The technology also allows the user to move, erase, enlarge, reduce, change the perspective, spin and change the colour of any section of the image.

Parts of other images can be also pasted onto the original; for example photographs of trees can be stored and the memory selected from a file when needed. They can then be charged in size and moved around the screen until a suitable place is found to "paste" them onto the original. It is possible to do this with any number of images finally producing a photograph-like image of a proposed environment.

For the most part this technology only allows the manipulation of still images. Sequential editing could be used to give a dynamic realism to the final video output. The video output is readily accepted by students and the general public. The low cost of this output makes it easy for students to produce a number of images to test their design ideas.

Hard copy output is achieved through dot matrix or colour ink jet printers. Colour photographs can be made directly off the screen or through additional hardware packages.

## COMPONENTS

At a total cost of approximately $20,000 the system is not yet at a stage where multiple units can be used in the classroom.

Given existing equipment found in most departments the cost is significantly reduced. The software package and the companion hard board cost approximately $6,500 and must be purchased. By using an existing commercial or institutional video camera and recorder and an AT or 286 level computer with a digitizer the technology is much more within the reach of many departments or schools.

## CONCLUSION

The technology described here can not replace the traditional graphic skills of the designer, but rather it utilizes these abilities and the designers design ideas to provide a highly realistic image in a familiar medium.

The power of the system is that it allows the designer/student to explore their design ideas quickly, easily and realistically. This then frees the student from the burden of simply graphically describing their ideas and allows more time to discover new directions in design.

# Desirable Classroom Confrontations

**J. Ogletree**
Division of Curriculum Studies
University of Western Ontario

Some students confront their professors over the perceived unfairness of a grade received or about the poor quality or degree of difficulty of assigned readings. Professors confront students about late laboratory or essay submissions or suspected plagiarism. These confrontations are characterized by friction and if emotions run high, heated verbal exchanges occur.

The type of confrontation which is considered a desirable teaching technique is presenting problems to the students and as far as their abilities and limitations of time permit, letting them solve the problems. New knowledge arises out of the problem-solving activity.

In secondary school classrooms it is very common for the mathematics teacher to begin a class with problems which move from the known problem to the challenge problem which represents the current study.

$2\,(2x + 7) =$
$2\,(3b - 2c) =$
$r\,(s + t) =$
$c\,(d - 2e + 4f) =$
$(a+b)\,(s+t) =$

An introductory problem may be presented in the form of a short personal story. "When I worked in Algonquin Park on the interpretative staff, the timber wolf population was 300 animals and the white tail deer population was 30,000. What further details do you need to know in order to determine the frequency of those two populations?"

In addition to confrontations being established or introduced by problems, they may be initiated by an attention-grabbing demonstration which requires explanations. It was the "faith-in-Physics professor" Dr. Miller who had a railway tie spike sledge-hammered into a cross section of a tree trunk resting on his chest. While still in a horizontal position on the floor, Prof. Miller initiated discussion which soon centred on the topic inertia and momentum. The lesson was well supported with other demonstrations but the initial one stimulated much thought and response to the professor's questions.

Lesson titles themselves may provide confrontations:

"They Don't Go Crunch Any More"

"The World of Edible Sins"

"Chalk Talk On Floc"

"Your Hand Is Showing"

"The Mole: Best Friend Of The Chemist

The Great Candle Mystery

These lesson titles provide initial motivation in the form of a challenge to students. Pupils ask themselves "What is the topic and focus today?" "They Don't Go Crunch Anymore" documents the decline in mayfly population and the lesson can start with the professor recalling past insect numbers around streetlights in a Lake Erie community. The life span of mayflies is short with adult life lasting only a few days and after mating and egg laying adults die. Mayfly bodies accummulated to such a degree that people walking on them produced an audible noise and at some intersections traffic accidents resulted from crushed mayflies making roadways slippery. The remainder of the lesson deals with present water quality of the Great Lakes in the 1980's.

What do you think the other lesson topics have as an affective, cognitive or psychomotor focus?

A fallacy or paradox establishes a confrontation.

$$a = b$$
$$a^2 = ab$$
$$a^2 - b^2 = ab - b^2$$
$$(a+b)(a-b) = b(a-b)$$
$$a+b = b$$

remember $a = b$

$$2b = b$$
$$2 = 1$$

A direct teacher statement may advocate a certain position that will stimulate students to then provide both pro and con positions. "Abortion appears to be used as an effective birth control measure in several countries. Let's explore the advantages and disadvantages of this intervention procedure."

A wide-ranging discussion initiated by the teacher can produce a pattern of disequilibrium and then point towards new knowledge. The discussion may start at the point where the professor has confronted students with statements contrary to their views or on account which they find difficult to believe on the basis of their past experience. "Pesticides should be banned immediately. They add tremendously to farm production costs, have only specific limited effectiveness and the long term result is likely a pesticide-resistant organism." A professor may wish to stimulate the same kind of discussion without the necessity of a devil's advocate statement. A number of case studies may be able to accomplish this.

As professors, we should be aware that students are coming to us with some background in case study analysis, some practice in pictorial reasoning and even laboratory sessions may utilize confrontation techniques at lower grade levels. The laboratory exercise which follows is mainly a rotation of stations with pupils filling as many of the blanks in the three columns as is possible.

Over half of the items which a teacher might set up at the different stations are listed. Students are told to base their response to the second column on their definition of a fossil which is recorded as the laboratory exercise begins. When the station rotation is complete, the teacher can continue the confrontation by determining that some students have called the majority of the objects fossils and others have reserved that label for only a very few items. Different fossil definitions are read and criteria discussed. Some teachers would continue the discovery aspect by assigning student reading and research on associated topics. Other teachers would make a motivational use of this introductory exercise and would then teach in a more formal fashion covering the content mainly via socratic and lecture format.

| | NAME OF OBJECT(S) | FOSSIL (Yes or No) | TYPE OF FOSSIL |
|---|---|---|---|
| 1 | Amber | | |
| 2 | Arrowhead | | |
| 3 | Beeswax | | |
| 4 | Bird Nest | | |
| 5 | Brachiopod | | |
| 6 | Cicada | | |
| 7 | Coal | | |
| 8 | Coral | | |
| 9 | Feather | | |
| 10 | Fish Vertebra | | |
| 11 | Kidney Stone | | |
| 12 | Pine Cone | | |
| 13 | Plastic Embedded Beetle | | |
| 14 | Shark Tooth | | |
| 15 | | | |
| 16 | | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | | | |
| 21 | | | |
| 22 | | | |
| 23 | | | |
| 24 | | | |
| 25 | | | |

Personal Definition of a Fossil: _____

_____

_____

If educators are saying to themselves "confrontations do not appear to be innovations in teaching" they are correct.

There is something of the juggler, the magician and the medicine wagon in the origins of confrontations of this type. Good teachers have long used many methods to motivate their students and the advertising technique of seeking attention followed by proclaiming the desirable qualities of the product is a standard approach. Professors now though have access to a wide array of audio visuals which can be used in a confrontational manner.

I'll describe a few of the 35mm coloured slides to be used in the demonstration portion of my presentation.

1. Pileated Woodpecker Holes In Trees

Students would not be given the title above. They would be told that I photographed this along the Bruce trail near Shelburne, Ontario. The question I would ask to initiate discussion "Have you observed similar vandalism?"

2. Winter Kill of Conifers

Students would not be given the above title. I photographed this scene at a London, Ontario nursery. "Explain how many of the evergreens shown in this picture became two - tone in colour."

3. Leaf Print

No title is provided. "How did the leaf leave its shadow on the sidewalk?"

4. Corn Totem Pole: Hundreds of Corn Ears on a Commercial Exhibit

No title is given to students but they are told I photographed this at the International Ploughing Match near Lucan, Ontario in 1982. "What improvements in genetics led to the increased yield visible on this single corn plant?"

These visuals and many more serve as confronting introductions or additions to lectures. The film loop which shows the collapse of the Tacoma Narrows

Bridge is an excellent visual aid for confrontation and follow-up discussion. Good questioning techniques are essential for continuing confrontation if there is a wish to do so.

Confrontations can be initiated if discrepant events are used. Anything considered mysterious, unexpected, or unknown can be used as a discrepant event. The game "Lunar Probe" can be used to demonstrate a steel sphere seemingly defying gravity by moving up an inclined plane. What other toys have lecture hall or laboratory application for presenting a problem? Are there recreational mathematics games which have this potential as well as familiar physics equipment such as radiometers?

Let's examine what several educators have said about the effect of contradictions, dilemmas and discrepant events:

**Piaget**

Contradictions met in the environment produce a pattern of disequilibrium. If resolved by an alteration in the individual's pattern of reasoning this is accommodation. The process of accommodating to new and discrepant information was called self-regulation by Piaget.

**Bruner**

Conjectures and dilemmas give life and direction to a body of knowledge. Both curriculum makers and teachers should provide exercises and occasions to nurture these conjectures and dilemmas.

Suchman

Students attempt to resolve contradictions which are encountered via demonstrations or other visual aids. Inquiry is stimulated if a filmloop shows a discrepant event. Suchman's theory on this is summarized below:

1. People inquire naturally when they are puzzled.
2. They can become conscious of and learn to analyze their thinking strategies.
3. New strategies can be taught directly and added to the students' existing ones.
4. Cooperative inquiry enriches thinking and helps students to learn about the tentative emergent nature of knowledge and to appreciate alternative explanations.

The use of the confrontation concept seems desirable for the following reasons:

It fosters independent thinking and drawing of conclusions. When used by students it indicates that they have learned how to learn.

The idea is independent of the basic teaching method used. Confrontation can be used with lectures, laboratories, field studies, visual aids.

The principle of confrontation gives one criterion by which to judge methodological innovations. It may be a good innovation if it allows confrontation to occur.

In Summary, classroom and laboratory confrontations are encouraged if they stimulate thought and encourage problem solving.

Acknowledgement:

The inspiration for this presentation was provided by Professor Emeritus J. S. Wright who delivered a paper to a STAO conference in the 1970's. Professor Wright's address was titled "Confrontation In The Classroom: Self-Regulation Applied". Books such as "Models of Teaching" 2nd edition by Joyce and Weil published by Prentice Hall in 1980 will give additional expressions of theory by Bruner, Piaget, Suchman and others.

# An Inexpensive Expert System Shell for Student-Developed Social Science Instructional Software

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## INTRODUCTION

One of the immediate consequences of installing microcomputer laboratories in instructional settings is the creation of a need for appropriate software. Directories describing such software have begun to appear (Stoloff and Couch, 1987) and software reviews are beginning to take their place beside textbook reviews (Butler, 1988). Although software is likely to appear for laboratory courses and for courses such as statistics (SYSTAT, 1986, 1987) it is uncertain if software will be available for a wider range of offerings in the near future. Fortunately, expert system development tools originally developed for business use can be used to develop tutoring software. The characteristics that make this possible include 1) ease of use, 2) high interactivity, and 3) low cost. In the remainder of this report we will describe one such expert system shell, selected on the basis of a series of positive reviews (Aguiar, 1987; Anacker, 1987; Olsen, Pumplin, and Williamson, 1987), and used in the past year to develop tutoring software in a variety of content areas.

## CREATING AN EXPERT SYSTEM

The expert system development tool described in the following report became available in 1986 and has been upgraded several times since its release (VP-Expert 1986, 1987, 1988). It is described as a rule-based expert system development tool and contains its own text editor, although external word processing software may be used with it. The software contains a clearly written manual that includes a tutorial.

At the DOS prompt, the program is loaded in response to the typed command VPX which displays the Main Menu shown in Figure 1 (all Figures appear at the end of the paper). The first step in developing an expert system using the program's text editor is to select 2INDUCE from the Main Menu. This selection is made using the arrow keys to move a highlight and striking the enter (RETURN) key or by simply typing the number that appears at the beginning of the selection -- in this case the number 2.

When the Induce Menu appears (Figure 2) 2CREATE is selected and entered. The display then asks for an identifying name for the expert system to be created. It is advisable to keep the name simple, limit yourself to less than eight letters or numbers, and essential not to use a period, colon, or an extension as part of the name. Enter the name selected with the enter (RETURN) key. You are now automatically in the text editor and can create a knowledge table which should be similar to the example called FREUD shown in Figure 3.

The text editing rules are simple and intuitive and are summarized in Figure 4 which is taken from the VP-Expert manual. Information is entered in the table so that each row reads left to right across as an "If - And - Then" statement. For example, in Figure 3, starting under the PSYCHIC-FUNCTIONS heading, the first row of the knowledge table would read: if the function is an ID function, and the level is Strong, then the adjustment is neurotic. The program has certain rules that must be followed while creating a knowledge table. For example, headings and descriptive statements cannot include spaces -- the easiest

solution is to use hyphens as shown in Figure 3. A second rule is that headings and statements for each column are limited to less than twenty-one characters in length and some characters are reserved.

Once the knowledge table is created, save it and exit the text editor using an ALT-F6 key combination (see editing rules, Figure 4); the Induce Menu (see again, Figure 2 ) appears automatically. Select 4TEXT on this menu and follow the directions in order to generate an expert system based upon your knowledge table. If no mistakes have been made while creating the knowledge table, the expert system will be automatically generated by the inference engine of the program.

To consult the expert system that has been generated, return to the Main Menu and select 4CONSULT. On the screen display that appears, select 2GO. The consultation display for FREUD is presented in Figure 5. In response to the initial query "What is the value of PSYCHIC-FUNCTIONS?" the ID was selected. In response to "What is the value of LEVELS?", the value of strong was selected and the ADJUSTMENT outcome (neurotic) appears in the lower right hand box. The program indicates a confidence (CNF) level of 100 percent since this was the level assumed in the "if" conditions. A second consultation reflecting the choice of EGO function at a Moderate level yields a "So-called-normal" adjustment outcome and is presented in Figure 6.

The box on the lower left of the screen displays each rule of the expert system as it is evaluated during a consultation. The rules scroll past and stop at the rule that applies. If no rule applies, the expert system scrolls to the last rule. In this case, in order to prevent the system from providing an incorrect conclusion, an appropriate "ELSE" rule must be written. A brief description of how this is done is included in the following section.

## MODIFYING THE RULES FILE

Thus far the focus has been on creating a knowledge table. However, once the knowledge table has been converted into a rules file by the inference engine of the program, the rules file becomes the focus. The rules file of the knowledge table identified as FREUD is presented in Figure 7. The rules file provides a natural language description of how the expert system works. The ACTIONS section of the file defines the goal of the program which, in this case, is to find the adjustment (neurotic or so-called-normal). The rules reflect the successive If-And-Then statements. Finally, the ASK statements at the end of the rules file provide the consultation queries and, as seen in Figures 5 and 6, the parts within quotation marks and the choices that follow appear during the consultation.

Although the rules file generated by the program is to some extent adequate, some changes are desirable and these can be made directly to the rules file by using the text editor. For example, the consultation question "What is the value of the PSYCHIC-FUNCTIONS?" can be changed to read "What Psychic Function do you wish to explore?" The program allows editorial changes of this kind as long as they appear inside the quotation marks. Comparable changes outside of quotes result in an error message.

Another, more important modification has already been mentioned in the preceding section. It is the nature of the program to move through each rule until a rule is satisfied--that is, until a rule is found that contains the appropriate "if - and" conditions. If this does not happen, the program evaluates all rules stopping only at the last rule. The last rule will be displayed at the conclusion to the consultation and this will be wrong since it appears only because it is the last rule. In the simple example of FREUD this situation will not happen because all possible choices during a consultation can be dealt with by the rules file. However, a more complicated knowledge table, such as the one dealing with brain/behavior relationships in Figure 8, provides possible choices for which no rules exist in the rules file.

For example, using the knowledge table in Figure 8, if during a consultation Limbic-System-1 is selected as the BRAIN-SYSTEM, but the AREA chosen is Prefrontal (from the top row) no rule exists that can lead to a FUNCTION. The easiest way to correct this limitation is to add an ELSE condition to the last rule of the rules file. The complete rules file generated from the brain/behavior knowledge table, with the ELSE statement added to Rule 11, is presented in Figures 9a and 9b.

When this is done, if the program moves through all rules to the last rule without satisfying any rule along the way, the ELSE condition is the only rule that passes. When it passes it displays "Unspecifiable" which is correct--that is, no function can be specified when an AREA of the brain is chosen that is not contained within the appropriate BRAIN-SYSTEM.

This description is only an introduction to the features available in this and other expert system development tools now available for instructional purposes. Many expert system shells, including the one

described here, include the ability to access external data bases, spreadsheets, and graphics packages. One of the most useful characteristics of these shells is that they are not content-specific. That is, they can be used to develop expert systems in unlimited range of topics.

In psychology courses at the University of Windsor, content of prototype expert systems developed to date include artificial intelligence (Weitzenbaum, 1976; McCorduck, 1979, Boden, 1987), statistics (Andrew, Klem, Davidson, O'Malley and Rogers, 1981), clinical diagnosis (DSM-III-R, 1987), psychoanalysis (Freud, 1924, 1975) and brain/behavior relationships (Carlson, 1986; Cooper, Bloom, and Roth, 1986).

## CONCLUSION

Inexpensive, highly interactive expert system development tools are now available for use with microcomputers. Students with little prior knowledge of computers can create knowledge tables, generate and modify rules files and carry out consultations with a few hours of supervised lab experience. With practice, selected students can produce their own self-tutoring software.

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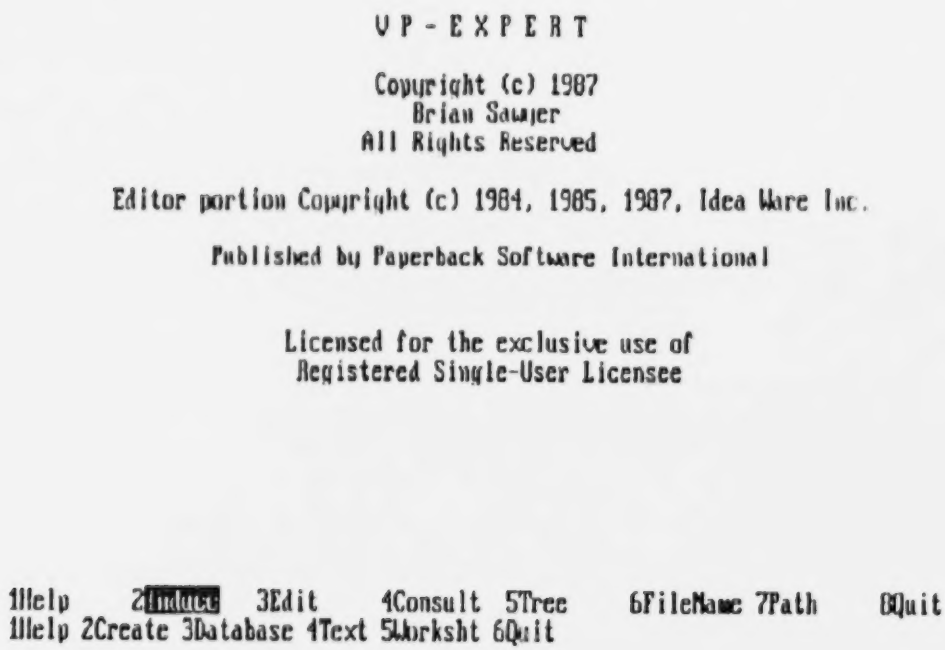
**Figure 1**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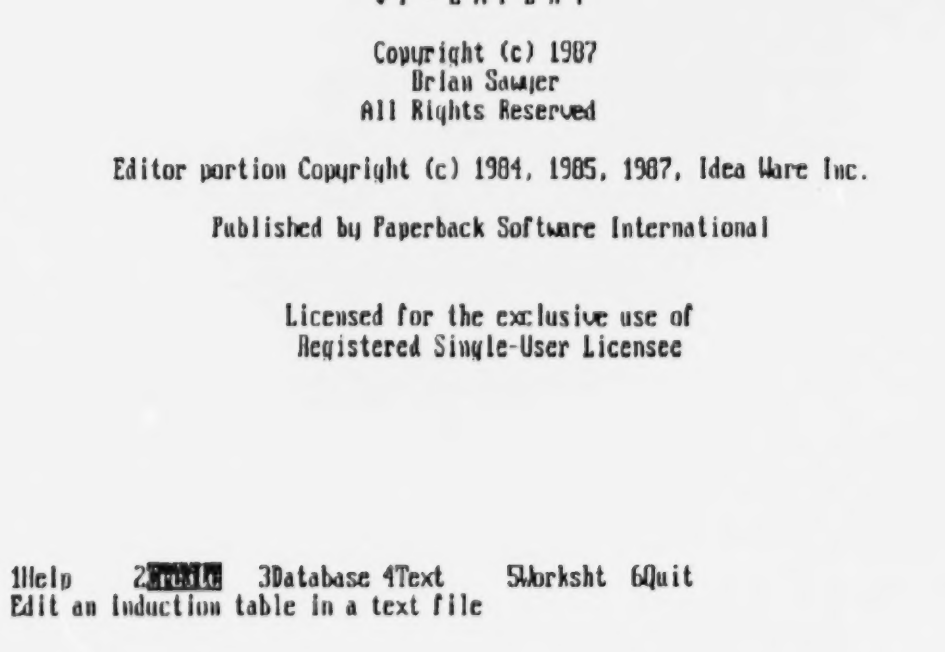
1Help 2Induce 3Edit 4Consult 5Tree 6FileName 7Path 8Quit
1Help 2Create 3Database 4Text 5Worksht 6Quit

**Figure 2**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Licensed for the exclusive use of
Registered Single-User Licensee
1Help 2Create 3Database 4Text 5Worksht 6Quit
Edit an induction table in a text file

**Figure 3**

```
                                                    Editing: Old File freud-0.tbl

PSYCHIC-FUNCTIONS       LEVELS          ADJUSTMENT◄
◄
     ID                 Strong          Neurotic◄
     ID                 Moderate        So-called-normal◄
     ID                 Weak            Neurotic◄
     EGO                Strong          Neurotic◄
     EGO                Moderate        So-called-normal◄
     EGO                Weak            Neurotic◄
  SUPEREGO              Strong          Neurotic◄
  SUPEREGO              Moderate        So-called-normal◄
  SUPEREGO              Weak            Neurotic◄

 ▲    ▲    ▲    ▲    ▲    ▲    ▲    ▲    ▲    ▲    ▲    ▲    ▲    ▲    ▲    ▲
Insert On    Document Off                          Boldface Off Underline Off
 1       2       3       4       5       6       7       8       9       10
```

**Figure 4**

## VP-Expert Editing Commands

| | |
|---|---|
| *RIGHT/LEFT ARROW* | Moves cursor right/left one character. |
| *UP/DOWN ARROW* | Moves cursor up/down one line. |
| *INSERT* | Toggles insert mode. Default is ON. |
| *TAB* | Moves cursor to next tab stop. |
| *SHIFT-TAB* | Moves cursor back one tab stop. |
| *CTRL-ENTER* | Adds a blank line. |
| *DEL (or CTRL G)* | Deletes character at cursor position. |
| *BACKSPACE* | Deletes character to left of cursor. |
| *CTRL-T* | Deletes from cursor to end of word. |
| *CTRL-Y* | Deletes line. |
| *ALT F6* | Saves file and leaves editor. |
| *ALT F8* | Abandons file without saving or changing. |
| *ALT F5* | Updates file without leaving editor. |

*Note: Hard carriage returns are indicated on screen with left triangles (◄).*

**Figure 5**

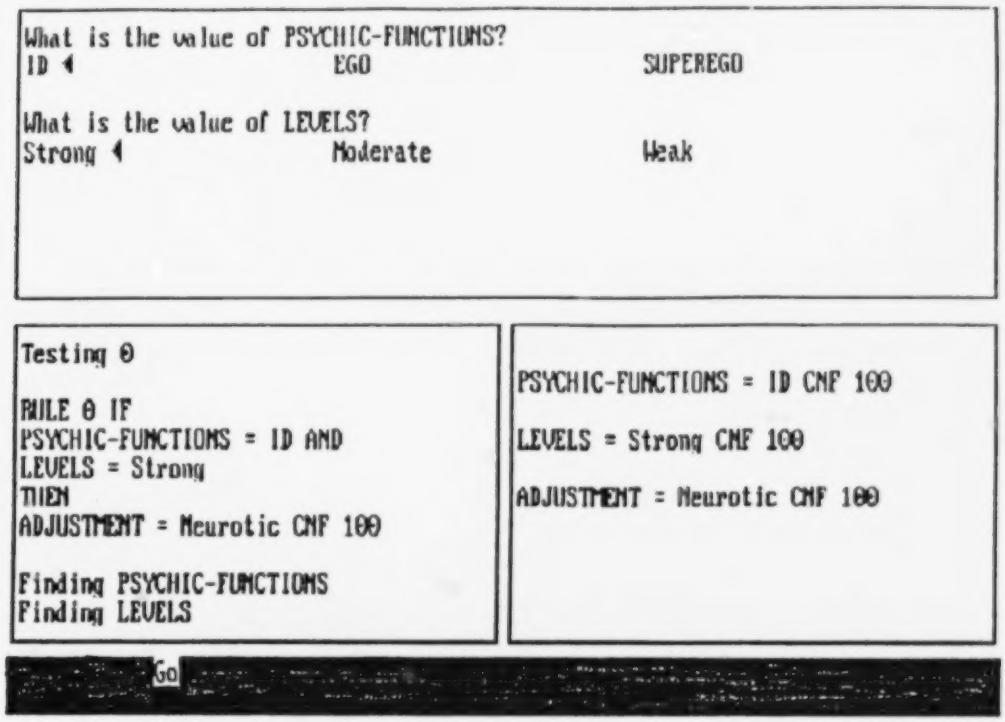


**Figure 6**

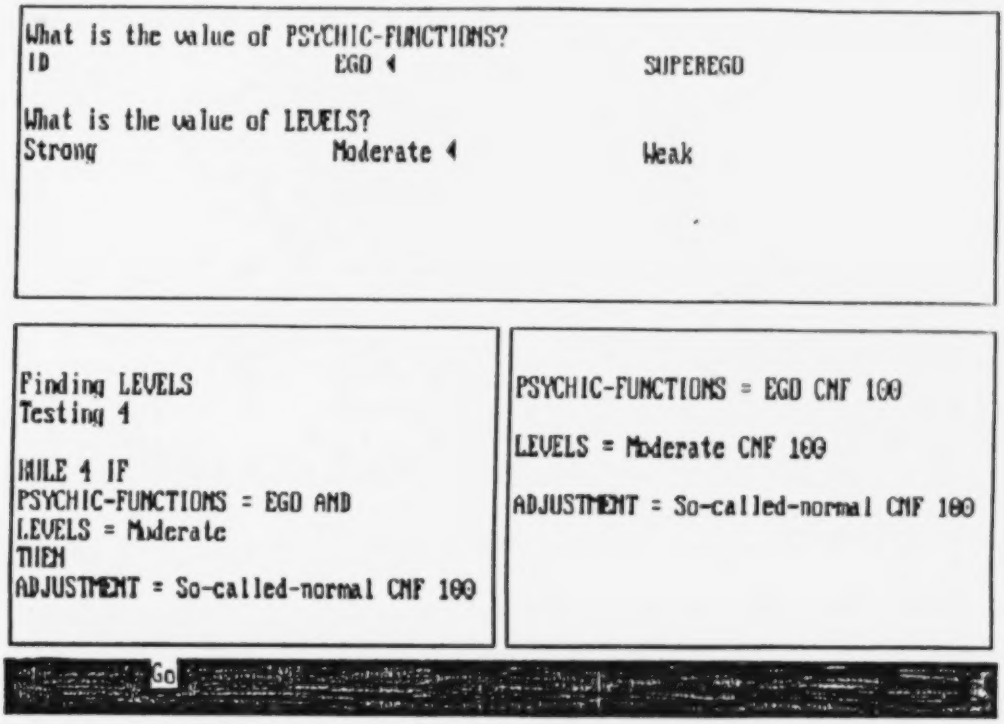

**Figure 7**

```
ACTIONS
        FIND ADJUSTMENT;

RULE 0
IF      PSYCHIC-FUNCTIONS=ID AND
        LEVELS=Strong
THEN    ADJUSTMENT=Neurotic;

RULE 1
IF      PSYCHIC-FUNCTIONS=ID AND
        LEVELS=Moderate
THEN    ADJUSTMENT=So-called-normal;

RULE 2
IF      PSYCHIC-FUNCTIONS=ID AND
        LEVELS=Weak
THEN    ADJUSTMENT=Neurotic;

RULE 3
IF      PSYCHIC-FUNCTIONS=EGO AND
        LEVELS=Strong
THEN    ADJUSTMENT=Neurotic;

RULE 4
IF      PSYCHIC-FUNCTIONS=EGO AND
        LEVELS=Moderate
THEN    ADJUSTMENT=So-called-normal;

RULE 5
IF      PSYCHIC-FUNCTIONS=EGO AND
        LEVELS=Weak
THEN    ADJUSTMENT=Neurotic;

RULE 6
IF      PSYCHIC-FUNCTIONS=SUPEREGO AND
        LEVELS=Strong
THEN    ADJUSTMENT=Neurotic;

RULE 7
IF      PSYCHIC-FUNCTIONS=SUPEREGO AND
        LEVELS=Moderate
THEN    ADJUSTMENT=So-called-normal;

RULE 8
IF      PSYCHIC-FUNCTIONS=SUPEREGO AND
        LEVELS=Weak
THEN    ADJUSTMENT=Neurotic;

ASK PSYCHIC-FUNCTIONS: "What is the value of PSYCHIC-FUNCTIONS?";
CHOICES PSYCHIC-FUNCTIONS: ID,EGO,SUPEREGO;

ASK LEVELS: "What is the value of LEVELS?";
CHOICES LEVELS: Strong,Moderate,Weak;
```

**Figure 8**

| BRAIN-SYSTEM | AREA | FUNCTION |
|---|---|---|
| Cer-Cortex-1 | Prefrontal | Cognition |
| Cer-Cortex-2 | Primary-Sensory | Precise-Sensory |
| Cer-Cortex-3 | Primary-Motor | Precise-Movement |
| Cer-Cortex-4 | Not-yet-known | Memory-Store |
| Limbic-System-1 | Sept-MFB-VTA | Reward |
| Limbic-System-2 | Hyp-St-Amygdala | Attack |
| Limbic-System-3 | Hippocampus | Process-into-Mem |
| Hypothalamus-1 | Dorsal-medial | Sympathetic-ANS |
| Hypothalamus-2 | Ventral-lateral | Parasymp-ANS |
| Hypothalamus-3 | Ventral-Pituitary | Growth-Gend-Diff |
| Retic-Form-1 | Ascending | Arousal |
| Retic-Form-2 | Descending | Muscle-Coord |

**Figure 9a**

```
ACTIONS
        FIND FUNCTION;

RULE 0
IF      BRAIN-SYSTEM=Cer-Cortex-1 AND
        AREA=Prefrontal
THEN    FUNCTION=Cognition;

RULE 1
IF      BRAIN-SYSTEM=Cer-Cortex-2 AND
        AREA=Primary-Sensory
THEN    FUNCTION=Precise-Sensory;

RULE 2
IF      BRAIN-SYSTEM=Cer-Cortex-3 AND
        AREA=Primary-Motor
THEN    FUNCTION=Precise-Movement;

RULE 3
IF      BRAIN-SYSTEM=Cer-Cortex-4 AND
        AREA=Not-yet-known
THEN    FUNCTION=Memory-Store;

RULE 4
IF      BRAIN-SYSTEM=Limbic-System-1 AND
        AREA=Sept-MFB-VTA
THEN    FUNCTION=Reward;

RULE 5
IF      BRAIN-SYSTEM=Limbic-System-2 AND
        AREA=Hyp-St-Amygdala
THEN    FUNCTION=Attack;

RULE 6
IF      BRAIN-SYSTEM=Limbic-System-3 AND
        AREA=Hippocampus
THEN    FUNCTION=Process-into-Mem;

RULE 7
IF      BRAIN-SYSTEM=Hypothalamus-1 AND
        AREA=Dorsal-medial
THEN    FUNCTION=Sympathetic-ANS;
```

**Figure 9b**

```
RULE 8
IF      BRAIN-SYSTEM=Hypothalamus-2 AND
        AREA=Ventral-lateral
THEN    FUNCTION=Parasymp-ANS;

RULE 9
IF      BRAIN-SYSTEM=Hypothalamus-3 AND
        AREA=Ventral-Pituitary
THEN    FUNCTION=Growth-Gend-Diff;

RULE 10
IF      BRAIN-SYSTEM=Retic-Form-1 AND
        AREA=Ascending
THEN    FUNCTION=Arousal;

RULE 11
IF      BRAIN-SYSTEM=Retic-Form-2 AND
        AREA=Descending
THEN    FUNCTION=Muscle-Coord
ELSE    FUNCTION=Unspecifiable;

ASK BRAIN-SYSTEM: "What is the value of BRAIN-SYSTEM?";
CHOICES BRAIN-SYSTEM:
Cer-Cortex-1,Cer-Cortex-2,Cer-Cortex-3,Cer-Cortex-4,
Limbic-System-1,Limbic-System-2,Limbic-System-3,
Hypothalamus-1,Hypothalamus-2,Hypothalamus-3,
Retic-Form-1,Retic-Form-2;

ASK AREA: "What is the value of AREA?";
CHOICES AREA:
Prefrontal,Primary-Sensory,Primary-Motor,Not-yet-known,
Sept-MFB-VTA,Hyp-St-Amygdala,Hippocampus,
Dorsal-medial,Ventral-lateral,Ventral-Pituitary,
Ascending,Descending;
```

# An Expert System Development Tool for Intelligent Tutoring in Cognitive Neuroscience

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## INTRODUCTION

The availability of expert system development software creates new opportunities for developing instructional software in microcomputer laboratories. Important requirements for such software include 1) interactivity, 2) ease of use, and 3) low cost.

After reading reviews (Aguiar, 1987; Anacker, 1987; Olsen, Pumblin, and Williamson, 1987) and trying several expert system shell "demos" , a PC-compatible product was selected for illustration in this report. Described as a rule-based expert system development tool, the manual claims that it "...allows virtually anyone to build an expert system (VP-Expert, 1986, 1987, 1988). The description is accurate. The non-copy protected program contains its own text editor (but permits the use of external word processing software) and comes with a clearly written manual that includes a tutorial. The software, upgraded in 1987 and again in 1988, is available for less than $100 U.S. through educational discount or from mail order companies. In the remainder of this report we will give a step-by-step example of a prototype expert system developed with this software.

## CREATING A KNOWLEDGE TABLE

At the DOS prompt, type the letters VPX which loads the program and displays the Main Menu shown in Figure 1 (all Figures appear at the end of this article). The first step in developing an expert system, using the program's own text editor, is to select 2INDUCE from the Main Menu. This selection is made either by using the arrow keys to move a highlight and then striking the enter (RETURN) key or by simply typing the number of the selection -- in this case the number 2.

When the Induce Menu appears (Figure 2), select 2CREATE. The program then asks for the name of the expert system that you wish to create. After typing the name you have chosen -- the prototype example used here is called BRAIN-01 -- press the enter (RETURN) key. You are now in the text editor and can create a knowledge table such as BRAIN-01 shown in Figure 3.

Information is entered in the table so that each row reads across as an "If-Then" statement. For example, in Figure 3 under the BRAIN-SYSTEM label, the top row of the table reads: If the brain system is the cerebral cortex, then (under the FUNCTION heading) the functions are cognition, sensory, motor, and memory storage (Cogn-Sens-Mot-MemSt). The abbreviations are somewhat awkward at first, but can be minimized as more elaborate knowledge tables are created.

The program has certain requirements that must be met in creating the knowledge table. The two most important are, 1) titles and descriptive statements in the knowledge table cannot include spaces or colons -- use hyphens to separate words as shown in the examples, and 2) titles and statements are limited in length). Notwithstanding these and other limitations, the text editor is easy to learn and intuitive. A summary of the major text editing rules appears in Figure 4.

Once the table is created, save it and exit (the Menu at the bottom of the screen tells how). The Induce Menu (Figure 2) appears automatically. To generate the expert system, select 4TEXT on this menu and

follow the instructions that appear on the screen. If no mistakes have been made in creating the knowledge table, the expert system is generated automatically.

To consult the expert system, return to the Main Menu (by selecting 6QUIT ) and select 4CONSULT. On the display that appears, select 2GO . The result for BRAIN-01 is presented in Figure 5. In this particular consultation, the question at the top of the screen (What is the value of the BRAIN-SYSTEM?) was responded to by highlighting the choice "Cerebral-Cortex." The arrow keys are used to make the selection, and then the ENTER and END keys are pressed. The result appears in the lower right box of the display . Thus, FUNCTION = Cogn-Sen-Mot-MemST CNF 100. The CNF 100 refers to confidence (CNF) level that is assumed to be 100% unless lower confidence levels are specifically indicated in the "If" conditions leading to the conclusion displayed. The box on the lower left of the screen displays each rule of the expert system as it is evaluated during a consultation.

The above prototype is the simplest expert system that could be imagined and, except as an instructional example, you would usually not generate such a simple expert system. At the same time, the addition of only a few "If" conditions quickly increases the complexity of the knowledge table, and the resulting expert system begins to show some signs of becoming "expert". For example, Figure 6 shows a knowledge table containing brain systems subdivided into brain areas with each area in a state of either activation or inhibition.

## MODIFYING THE RULES FILE

Up to this point, the focus has been on creating knowledge tables (see again, Figures 3 and 6). However, once the knowledge table has provided raw data for generating the expert system, the focus shifts to the rules file. The rules file displays the logic of the expert system in natural language. However, in the form created by the program's inference engine, the rules file is somewhat awkward. To develop a more smooth-running expert system, the rules file usually requires some modification. The rules file generated for BRAIN-01 is presented in Figure 7.

The most important part of the rules file is the ACTIONS BLOCK. In this example, the ACTION specified for BRAIN-01 is simply FIND FUNCTION -- which the expert system does. The other parts of the rules file are RULES and STATEMENTS which in this particular example again are quite limited. The consultation with BRAIN-01 presented in Figure 5 demonstrates some of the reasons why modification of the Rules File is appropriate. For example, to read smoothly, the word "value" at the beginning of the consultation needs to be changed to a more appropriate word such as "name." Other changes that can be made include adding titles, cleaning up the appearance of the consultation screen, and streamlining the consultation process. All of these can be done by directly editing the rules file.

To illustrate the result of this editing, the knowledge table for the more complex expert system BRAIN-ES (see again, Figure 6) has been used to generate a rules file which has then been modified. When consulting this expert system, the first screen that appears is the title displayed in Figure 8. As selections are made in response to successive questions, the displays in Figures 9, 10, 11, and 12 appear.

This brief description touches upon only a few of the features provided by the new generation of inexpensive expert system development tools now available for instruction in cognitive neuroscience. Although the use made of them depends upon the user's instructional approach, the most effective use may be to direct students to specific neuroscience content from readily available sources (Angevine & Cotman, 1981; Carlson, 1986; Shepherd, 1987) so that the students themselves can create knowledge tables and generate their own expert systems for self-tutoring.

## CONCLUSION

Inexpensive, expert system development tools are now available for use with microcomputers. One example of a rule-based expert system shell has been described in this paper. Using this or similar development tools, students can create their own knowledge tables, generate and modify rules files, and carry out consultations within a few hours. With practice, students can produce their own interactive software for self-tutoring.

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Figure 1

V P - E X P E R T
Copyright (c) 1987
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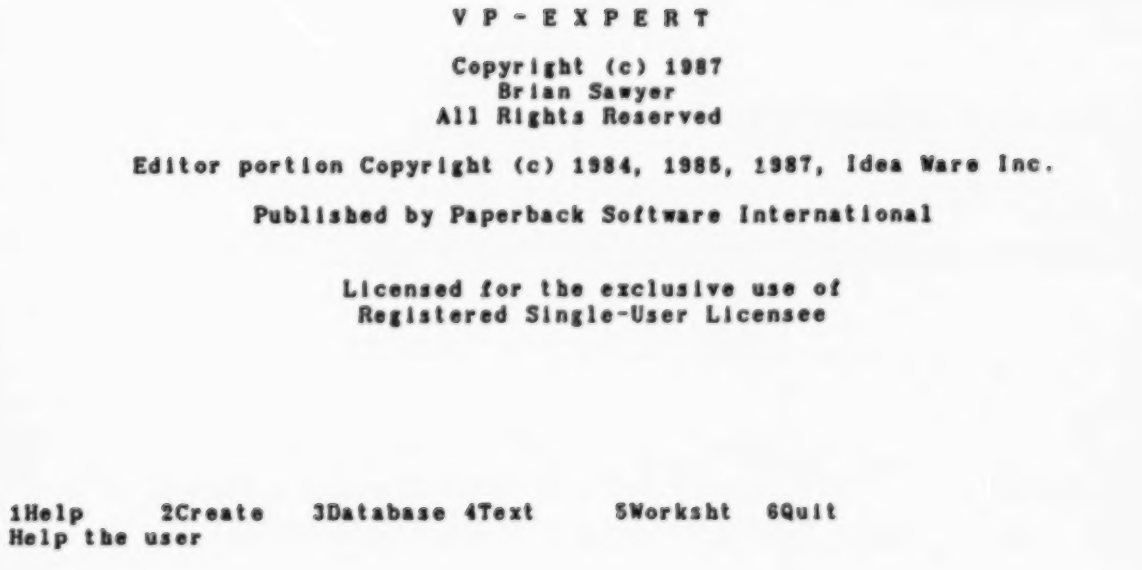
Editor portion Copyright (c) 1984, 1985, 1987, Idea Ware Inc.
Published by Paperback Software International
Licensed for the exclusive use of
Registered Single-User Licensee
1Help 2Induce 3Edit 4Consult 5Tree 6FileName 7Path 8Quit
Help the user

Figure 2


V P - E X P E R T
Copyright (c) 1987
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Editor portion Copyright (c) 1984, 1985, 1987, Idea Ware Inc.
Published by Paperback Software International
Licensed for the exclusive use of
Registered Single-User Licensee
1Help 2Create 3Database 4Text 5Worksht 6Quit
Help the user

**Figure 3**

| BRAIN-SYSTEM | FUNCTION |
|---|---|
| Cerebral-Cortex | Cogn-Sen-Mot-MemSt |
| Limbic-System | Rewrd-Attck-MemPr |
| Hypothalamus-Pit | Symp-Paras-GendDif |
| Retic-Formation | Arousal-MusclCoord |

**Figure 4**

## VP-Expert Editing Commands

| | |
|---|---|
| *RIGHT/LEFT ARROW* | Moves cursor right/left one character. |
| *UP/DOWN ARROW* | Moves cursor up/down one line. |
| *INSERT* | Toggles insert mode. Default is ON. |
| *TAB* | Moves cursor to next tab stop. |
| *SHIFT-TAB* | Moves cursor back one tab stop. |
| *CTRL-ENTER* | Adds a blank line. |
| *DEL (or CTRL G)* | Deletes character at cursor position. |
| *BACKSPACE* | Deletes character to left of cursor. |
| *CTRL-T* | Deletes from cursor to end of word. |
| *CTRL-Y* | Deletes line. |
| *ALT F6* | Saves file and leaves editor. |
| *ALT F8* | Abandons file without saving or changing. |
| *ALT F5* | Updates file without leaving editor. |

*Note: Hard carriage returns are indicated on screen with left triangles (◄).*

**Figure 5**

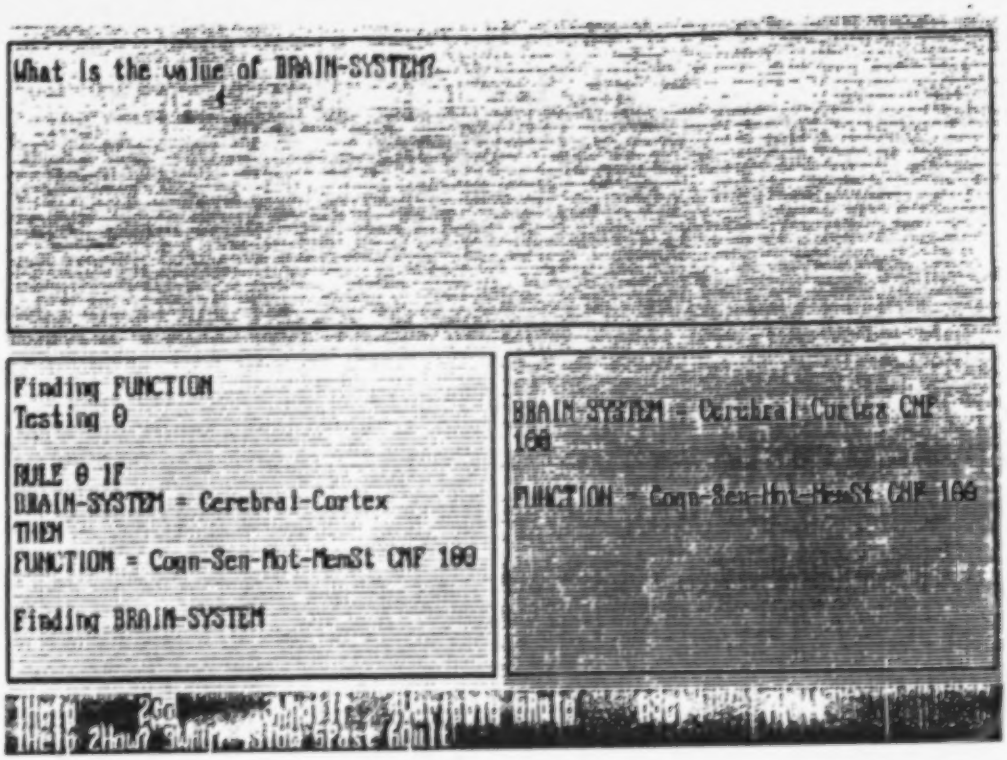

What is the value of BRAIN-SYSTEM?
4
Finding FUNCTION
Testing 0
RULE 0 IF
BRAIN-SYSTEM = Cerebral-Cortex
THEN
FUNCTION = Cogn-Sen-Mot-MemSt CNF 100
Finding BRAIN-SYSTEM
BRAIN-SYSTEM = Cerebral-Cortex CNF
100
FUNCTION = Cogn-Sen-Mot-MemSt CNF 100

**Figure 6**

| Brain-System | Area | State | The-Function |
|---|---|---|---|
| Cerebral-Cortex | CC:Prefrontal | Activation | Increased-Cognition |
| Cerebral-Cortex | CC:Prefrontal | Inhibition | Decreased-Cognition |
| Cerebral-Cortex | CC:Primary-Motor | Activation | Increased-Movement |
| Cerebral-Cortex | CC:Primary-Motor | Inhibition | Decreased-Movement |
| Cerebral-Cortex | CC:Primary-Sens | Activation | Increased-Sensation |
| Cerebral-Cortex | CC:Primary-Sens | Inhibition | Decreased-Sensation |
| Cerebral-Cortex | CC:Undetermined | Activation | Incr-Memory-Store |
| Cerebral-Cortex | CC:Undetermined | Inhibition | Decr-Memory-Store |
| Limbic-System | L:Sept-MFB-VTA | Activation | Increased-Reward |
| Limbic-System | L:Sept-MFB-VTA | Inhibition | Decreased-Reward |
| Limbic-System | L:Hyp-St-Amygdala | Activation | Increased-Attack |
| Limbic-System | L:Hyp-St-Amygdala | Inhibition | Decreased-Attack |
| Limbic-System | L:Hippocampus | Activation | Incr-ProcIntoMem |
| Limbic-System | L:Hippocampus | Inhibition | Decr-ProcIntoMem |
| Hypothalamus | H:Dorsal-medial | Activation | Incr-Sympathetic-ANS |
| Hypothalamus | H:Dorsal-medial | Inhibition | Decr-Sympathetic-ANS |
| Hypothalamus | H:Ventral-lateral | Activation | Incr-Parasymp-ANS |
| Hypothalamus | H:Ventral-lateral | Inhibition | Decr-Parasymp-ANS |
| Hypothalamus | H:Vent-Pituitary | Activation | Incr-Grwth-Gend-Diff |
| Hypothalamus | H:Vent-Pituitary | Inhibition | Decr-Grwth-Gend-diff |
| Reticular-Form | RF:Ascending | Activation | Increased-Arousal |
| Reticular-Form | RF:Ascending | Inhibition | Decreased-Arousal |
| Reticular-Form | RF:Descending | Activation | Incr-Muscle-Coord |
| Reticular-Form | RF:Descending | Inhibition | Decr-Muscle-Coord |

**Figure 7**

```
ACTIONS
        FIND FUNCTION;


RULE 0
IF      BRAIN-SYSTEM=Cerebral-Cortex
THEN    FUNCTION=Cogn-Sen-Mot-MemSt;

RULE 1
IF      BRAIN-SYSTEM=Limbic-System
THEN    FUNCTION=Rewrd-Attck-MemPr;

RULE 2
IF      BRAIN-SYSTEM=Hypothalamus-Pit
THEN    FUNCTION=Symp-Paras-GendDif;

RULE 3
IF      BRAIN-SYSTEM=Retic-Formation
THEN    FUNCTION=Arousal-MusclCoord;

ASK BRAIN-SYSTEM: "What is the value of BRAIN-SYSTEM?";
CHOICES BRAIN-SYSTEM: Cerebral-Cortex,Limbic-System,
                      Hypothalamus-Pit,Retic-Formation;
```

**Figure 8**

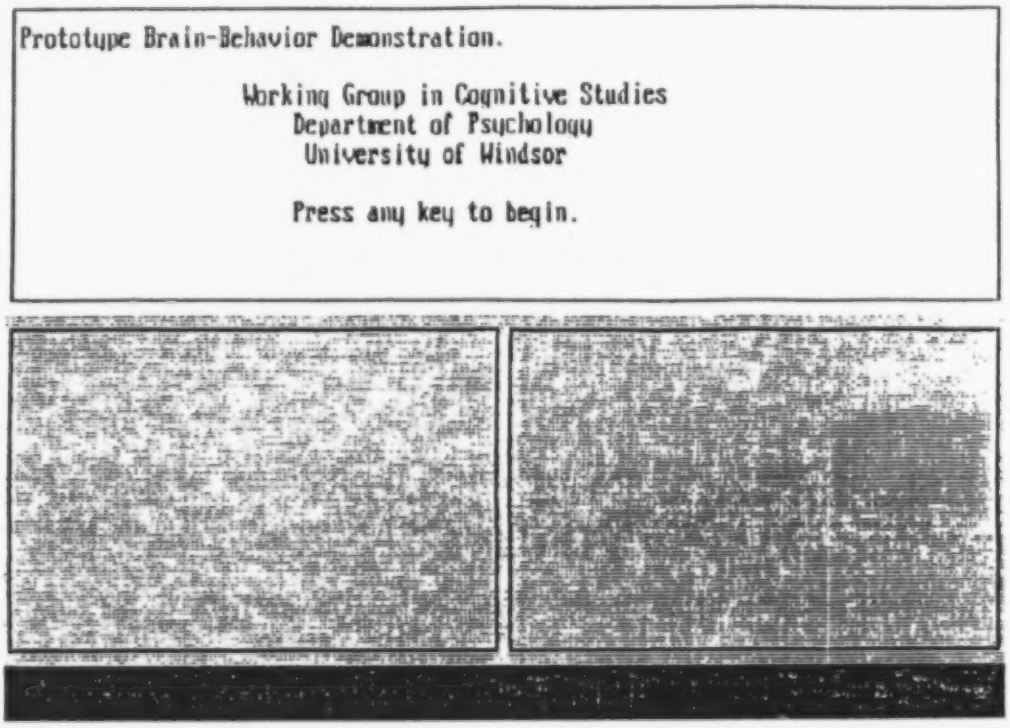


**Figure 9**

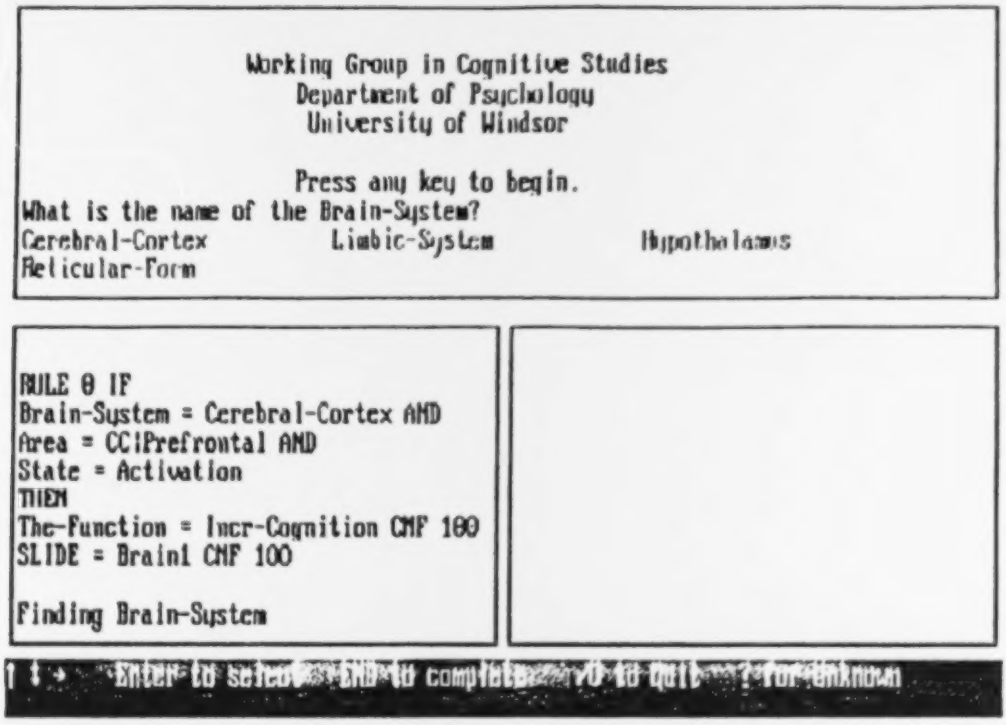



**Figure 10**

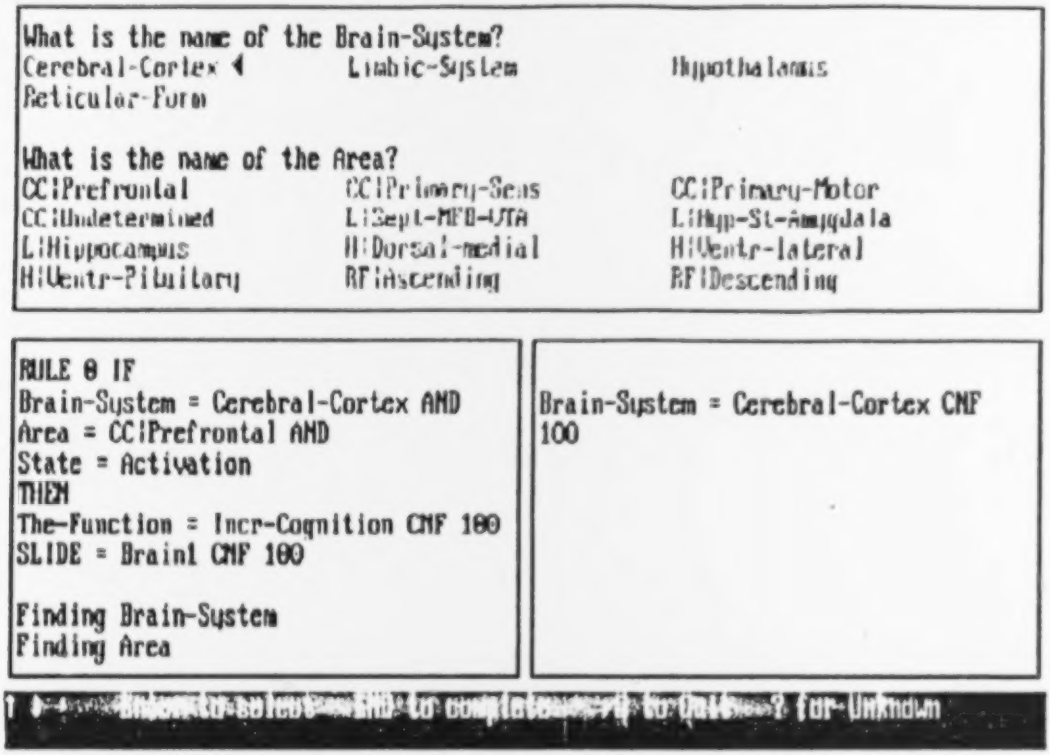


**Figure 11**

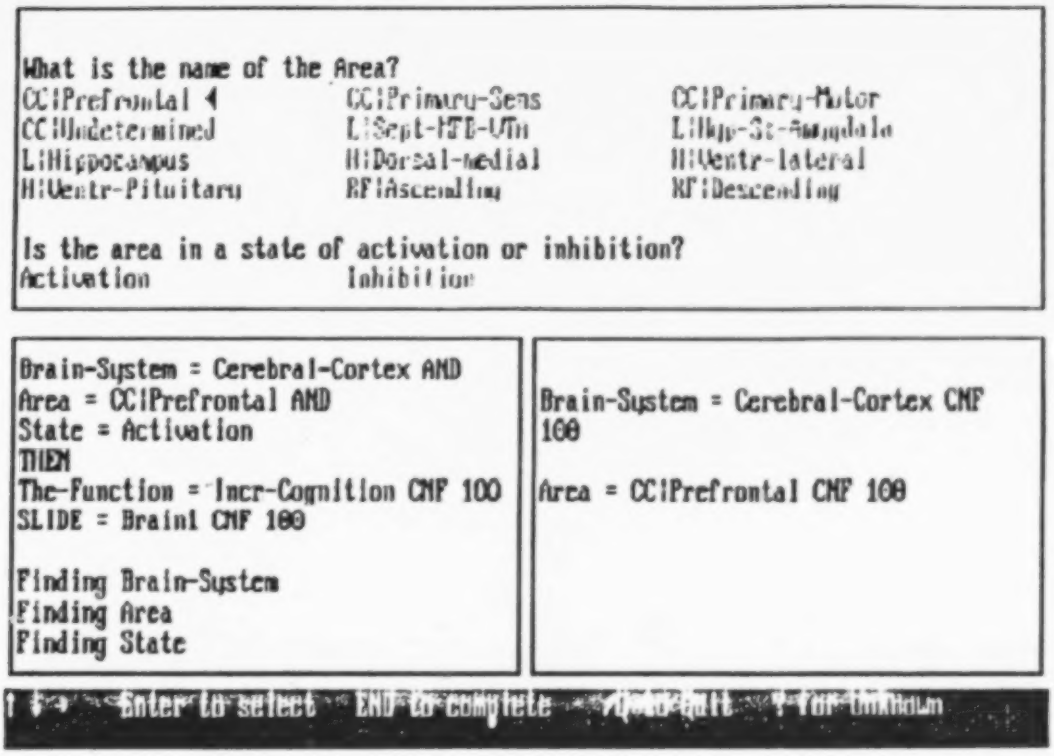
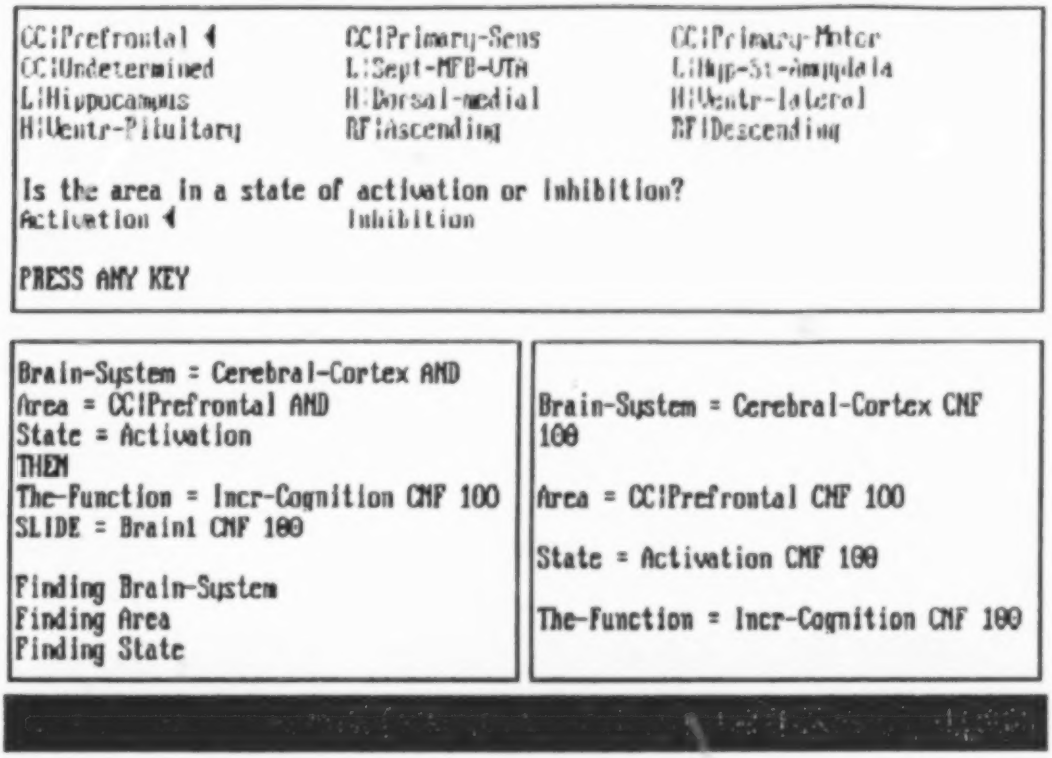



**Figure 12**



# Interactive Videodisc Instruction (IVI)

**Peter Richardson P.Eng.**
Tayson Systems Inc.

Interactive Videodisc Instruction (IVI) allows you to extend the limits of conventional computer based learning concepts with the integration of random access video frames or sequences, with associated audio. IVI systems allow you to generate any combination of integrated computer graphic and video images to satisfy your training requirements.

The added dimensions of live picture and sound provide the student explicit feedback resulting from her/his answer. This may illustrate the:

a) simulation of operating a piece of equipment
b) diagnostic procedures within a medical environment
c) events or attractions in the immediate area

IVI provides two audio channels to select from, allowing bilingual delivery of information.

A videodisc can store 54,000 still frames or 30 minutes of motion video on each side of the disc and combined with a personal computer and authoring system, can generate innovative learning modules.

Hundreds of general information Videodiscs are available in the marketplace covering a wide range of educational topics.

An IVI authoring system allows you to use these general information discs:

a) to play the video in the order of your choice
b) overlay your graphics and questions on top of the video image and create training modules.

One such authoring system is VISION.

EASE OF USE, is the "bottom-line" of VISION.

Eliminated is the need to learn an authoring language; VISION emphasizes the design, development and delivery of training modules.

Menus and prompts guide you from initial frame creation through module design and publishing; NO previous technical experience is required.

The flexibility of VISION allows it to run on a variety of hardware configurations.

Included in the complete support for VISION is, initial training, full documentation, tutuorial, reference manual, customer service, maintenance and new releases.

## VISION System features

**General**
- instructors can create full-color animated computer graphic images
- hardware and display independent graphics with text editor

**Module Pages can:**
- contain any combination of computer graphics, text and/or videodisc frames
- execute third party programs and control external hardware devices
- be randomly generated and check for partially correct answers or spelling errors
- work with a variety of input devices

**Completed Modules and Session Files**
- session files are created for all student input and reports are available to analyze results
- modules can be published and delivered by diskette, modem or network
- students can be registered to selected modules

**Hardware Requirements**
- IBM PC/XT/AT, PS/2 or compatible
- 512K memory
- 1 diskette drive and hard drive
- color graphic card and color monitor

Optional: Videodisc, Mouse, Graphic tablet, Light pen, touch screen. Please call us for the latest list of graphic cards, video overlay cards and video display systems that the system runs on.

# A Method for Interactive Seminars

**Frans J. Schryer**
Department of Sociology and Anthropology
University of Guelph

A widely-held assumption in university is that the seminar is not a suitable teaching strategy for lower-level students. Seminars are generally reserved for more advanced senior students (preferably honors students) or graduate students. Even here, complaints are often heard about the poor quality of oral presentations, the low level of participation in group discussion and lack of preparation. Several university educators have suggested ways in which the seminar might be improved (see Nisbet, 1966; Stanton, 1980?). However, such an improved seminar is still designed specifically for advanced students, so that "already clever students" may now learn "to be wise" (Nisbet, 1966:349). In this article I will propose an alternative seminar suitable for not so advanced students, to promote student development. The aims of such seminars are to get students more involved in the education process and to take more responsibility for their learning. In the process they will hopefully develop better analytical and critical thinking skills, which should also show up in their academic writing.

The seminar format to be outlined below was developed through a process of trial and error over several years of teaching second or third semester students at the University of Guelph. During this process of experimentation I was strongly influenced by the philosophy of learning and the specific workshops techniques developed by Cathy Foy-Schryer who was at that time the English language services coordinator. Her general approach could be summarized as a model of teaching as an ongoing dialogue between teacher and students and among students themselves. I started applying this approach in order to overcome a number of problems I had earlier encountered in the classroom.

In the past, only a student assigned to do a particular seminar presentation would do the required reading and he or she would then read aloud what usually turned to be a report that was too long. Apart from the occasional presence of already highly articulate group leaders, it was usually difficult to stimulate class discussion and other students would not ask questions. Most students felt that they "didn't know enough about the topic" or were unwilling to admit that they had not done the readings or would want to talk about completely different topics not related to the course. Even the student doing the seminar presentation would rarely express their own opinions or develop their own insights or criticism of the readings assigned for discussion. In the end, I usually ended up monopolizing or dominating the conversation or worse, slip back into a lecture mode. The seminars I run today look quite different.

A Sample Seminar

Most of my new seminar courses (or their seminar component) are based on a set of readings, consisting of anywhere from ten to fifteen articles taken from academic journals or chapters from readers. These are usually arranged in a logical or chronological order. The total number of students enrolled in such seminar courses ranges from ten to thirty (at most) and all students are expected to read all the material (like before). The format of the seminar meetings (1 1/2 or 3 hours), and the necessary preparation and follow-up work as follows:

I Prior to the actual class meeting

1. A student or group of students (no more than 4) are responsible for designing several questions related to the readings assigned for the next class. These questions are meant to stimulate discussion about what the article is about (its main theme), underlying assumptions and how the article related to other readings or topics covered in the course.

a. The questions are brought to class (to be handed out or written on the blackboard). The questions should ideally contain a blend of more specific and more general questions; of questions which are directly related to the article under discussion and others which go beyond the article.

b. The students are free to design their own questions but I offer to look at their questions beforehand (for clarification and assistance) and, if necessary (usually at the beginning of the course) I can also give them some suggestions or questions of my own.

II In the classroom (round-table style)

1. The class is divided up into smaller groups (or no more than five). Each group discusses one of the questions (or alternatively, one specific and one more general question).

a. The student(s) who designed the questions should ideally join each of the discussion groups. They are not required to act as group leaders, although they may need to clarify the intent of the questions if necessary.

b. The instructor leaves the room for about twenty minutes. The purpose of this is to give an opportunity for the students to freely express their ideas, ask questions and develop their ideas without worrying about being evaluated on the quality of their oral performance.

c. Any technical terms which no one can explain can be put on a place in the blackboard for later explanation, if necessary.

d. When the instructor returns to the classroom (everyone is usually talking), s/he may then circulate from group to group to join the discussion, answer questions or simply observe the group interaction.

e. An attendance sheet is passed around during the discussion (see later section of evaluation) and an honour system (plus peer pressure) is used to ensure that all the students have done their readings. It is expected that students usually bring a copy of the article in question to class (with pencil notes in the margins) or a piece of paper with notes or comments (for their own use).

2. About three quarters of the way through the seminar (or after a break), a spokesperson for each group presents a short 5 minute summary of their discussion (usually in the form of an answer to the question that was discussed) to the rest of the class.

a. The instructor acts as moderator or chairperson.

b. The answer does not have to be unanimous; some groups may want to report on differences of opinion or disagreements.

c. Ideally (depending on time constraints) the answer or summary should be put in writing. Alternatively, one of the people who originally designed the questions for discussion could take notes.

d. There is some flexibility in who makes the brief oral report on behalf of the group; it could be one of the people who designed the original questions or each group could appoint a different spokesperson for every week. Ideally everyone should have a turn doing this sometime during the course.

3. Again, depending on the nature of the group dynamics, scheduling and time constraints, some time might have to be set aside at the beginning or the end of the class to allow the 3 or 4 students who designed the original questions to get together to coordinate or consolidate their efforts.

III After the seminar meeting

1. The original group of students who designed the questions for group

discussion are responsible for preparing a two or three page report or outline, summarizing the article and also going beyond the article (criticism, analysis or relating the article to the broader literature)

a. This must be group effort; the students may work individually and then amalgamate their individual reports, they may want to divide up the work (each do a section) or even write a majority and a minority report.

b. The format is flexible. I usually recommend the use of headings and sub-headings and will allow point-form sentences as long as the introduction and conclusion (or final critical comments) are done in proper paragraph format. Sections of the report may also be written in the form of a dialogue between two or more real or hypothetical persons.

c. The content is flexible as well. The students are free to either incorporate or ignore the insights provided by the class discussion (they are not expected to prepare a set of minutes) and are encouraged to be creative in the manner in which they write their report as long as they include a concise summary of the article and also go beyond the article in some fashion.

2. A type-written copy of the seminar/article report must be ready within a week (or ten days) for distribution to the rest of the class. This report is the outcome of a group project (if 2 or more students work together), but, in a sense, it is also a group product since the entire class contributed to this report through their input and discussion.

a. A rough copy of this report must be handed in to the instructor first, who then provides feedback, including editorial comments. I do this on a word processor and I usually prepare anywhere from

one paragraph to a full page of comments. Each of my comments corresponds to or refers to a number I put in pencil in the margin of the report. My role is thus one of editor who has to be critical but at the same time respect the written work handed in.

b. I am willing to give feedback on the first draft of either a single group report or on individual reports (with suggestions as to how they should be amalgamated).

c. The student(s) then go back to the drawing board and produce a polished final version, suitable for distribution to the rest of the class.

This whole cycle of question preparation, group discussion and final report writing is repeated every week until the end of the course (or a segment of a course). At the end of the course, each student will not only have read and learned the material in each article but they will also have a set of reports which they can use for future reference or to help them prepare for a final individual assignment, which could take the form of a take-home exam.

Method of Evaluation

Students are not formally evaluated (graded) for designing their questions, for the quality of group discussion or for the first draft of their report. In each instance, however, I give lots of feedback in terms of critical comments and suggestions for improvement. The final group report (done by one or more students) is then given a mark (let's say out of twenty). In addition, every student automatically gets a mark based on the attendance sheets handed out during each seminar. However, I make it quite clear that this is a participation mark (including preparatory reading), not a mark for just showing up. Students are told they should not attend class if they have not done the necessary

reading, because they are expected to come prepared to discuss the article and ask for further clarification. This does not mean that the student is expected to fully comprehend each article (this comprehension is one of the purposes of the seminar discussions). An individual student grade is also given for a separate, final assignment (a final exam or paper).

The philosophical principle underlying this method of evaluation (as well as the entire seminar format) is that students should be encouraged to learn to think through practice and group interaction. I believe that students should not be penalized for expressing initial doubts or for "making mistakes" in the process of learning how to think for themselves and to write in an academic setting. For this reason I prefer to use the distinction between evaluation (feedback) and inspection (final grading) made by Paulo Freire (1972), a Brazilian educator. This distinction is similar to that between formative and summative evaluation used by many educators in North America. The task of the teacher (even at the level of university) is to help the weaker or less advanced students to fulfil their potential. This is why I do not assign numerical grades for first copies of the final report or the quality of group discussion. Even the grade for the final draft of the seminar report is subject to upward revision if the student's performance shows noticeable improvement by the end of the course. At that time only, do I decide whether a student is worth an A, a B or a C (or less).

## Summary and overview

The seminar I have outlined was the outcome of a lot of experimentation which involved false starts and many errors. For example, initially I did not provide enough structure for the seminar discussions nor sufficient feedback to ensure a good quality seminar report. Some of the techniques I use (for example, having students design their own initial questions) came from sugges-

tions made by students themselves. No doubt there is room for further innovation; for example, I might try to get the students to take over some of the responsibility of editing each other's work. The special needs of each class and the nature of the subject matter might also require a slightly different approach. I recognize that the method proposed in this paper might work better with more mature students or students who are already committed to the subject of the course. If fact, my most successful run was a course I gave at Atkinson college (York University) for a group of students in continuing education. However, I have found that even students who did not take my seminar courses out of choice appreciated the opportunity to take a more active role in the process of learning.

Other instructors may have to operationalize the general principle of active learning and interaction (between instructor and students and among students) in other ways. My model seminar is only an example, not a ready-made recipe that could be applied to every situation. I certainly cannot guarantee that any method using the general principles I have enunciated will be less time-consuming or enabled one to teach bigger classes more efficiently. However, I found that my teaching became personally more rewarding, even though it often took more time in planning, organization and providing feedback. I especially advocate my approach for those interested in student development. The more advanced students can easily learn on their own and don't need constant feedback and encouragement. They don't really require good teachers -- only a knowledgeable resource person and an efficient library.

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# Chess in the Teaching of Critical Thinking

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Philosophy Department
University of Guelph

An important component of critical thinking is the capacity to perceive logical relationships. Can this capacity be schooled or is it entirely a function of native intelligence? The present paper is predicated upon the assumption that schooling is possible based upon either of two methods: 1. the application of mechanical techniques such as Venn Diagrams, truth-tables, etc.; 2. puzzle-solving. The first method must be used wisely else it might cripple the ability to discover logical connections without mechanical crutches. The second method counteracts reliance upon rote procedures, since a good puzzle invariably calls forth a certain degree of "creativity" on the part of the solver.

The present paper is concerned with the aesthetics of puzzles, an important matter from the pedagogic viewpoint. It is most important that students should not equate the idea of a puzzle with the idea of a difficulty surmountable only by superior intelligence. To be sure, difficulty in some measure is the sine qua non of a puzzle. But a puzzle is also a thing to be enjoyed; and this enjoyment, if stressed in the right way, can be a powerful motivator in the teaching situation. From the standpoint of enjoyment, chess puzzles ("problems" is the term preferred by afficianados) have particular advantages and, when introduced innovatively in my course, Critical Thinking (Philosophy 74-210), met with enthusiastic student response.

I believe there are two main kinds of aesthetic "payoff" from solving puzzles. The one kind I call, following Martin Gardner (1) the "Aha!". The other, and perhaps more significant one, I call "intellectual beauty".

Most puzzles reward the solver with an "Aha!" - a moment of thrilling and sudden revelation. For an illustration consider the chestnut, "Brothers and sisters have I none, but that man's father is my father's son. Who am I?" It is an "Aha!" to realize that since the speaker in the puzzle has no brothers he must himself be his father's son. I.e., from the speaker's standpoint, my father's son = me. (It is clear at once from this "Aha!" that the speaker can be identified more specifically as the father of "that man".)

In a chess problem, the "Aha!", while certainly present, plays a subordinate role. The main aesthetic value embodied in a chess problem is intellectual beauty. Intellectual beauty is based upon tasteful exploitation of theme and variations. It is similar to the beauty found in certain art forms except that the medium of expression is pure thought. There is a complex network of logical relationships, but the complex is held together by one or more motivic ideas. For instance, there may be several distinct variations (a variation, in the context of a chess problem, is a sequence of moves resulting from a particular Black defense to White's initial or key move) all of which exemplify the theme of Grimshaw interference - the mutual interference of rook and bishop. I daresay the pleasure in apprehending this sort of unity-in-variety is something like the pleasure of listening to good jazz or perhaps a Bach fugue. Students, after a modicum of training, are quite capable of appreciating a fine chess problem and feel enriched for doing so. The intense activity called forth by solving gives one the feeling of recreating the same exquisite pattern created by the composer, and this can be an intensely absorbing experience. It is an experience which counteracts intellectual passivity in the strongest possible way.

One excellent way to present chess problems in the classroom situation is by means of a demonstration board. Such a board measures about 68 x 81 cms. and is clearly visible even in a large classroom. A board, complete with pieces, costs about $20 and is obtainable from the Chess Federation of Canada.

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(1) Martin Gardner, Aha! Insight (New York City: W.H. Freeman and Company, 1978).

# Applying a Computer Based Spatial Analysis System in a Studio Teaching Format

**James R. Taylor**
School of Landscape Architecture
University of Guelph

## INTRODUCTION

New computer technologies have been developed to assist in thelandscape planning process. Increases in the power and theaffordablity of microcomputers, coupled with new sophisticatedsoftware has improved the accessibility of the new technology for research, education and practical application purposes. In the School of Landscape Architecture new computer-assisted planning technology has been acquired with the past year for research applications. The purpose of this study was to explore the ways and means to move the technology from the research laboratory to the teaching studio in landscape planning.

## THE TECHNOLOGY

The School of Landscape Architecture at the University of Guelph was fortunate in 1987 to receive a grant to purchase a state-of-the-art Geographical Information System (GIS). A computer based GIS provides the tools for collecting, storing, retrieving, transforming, displaying and manipulating spatial data from the physical and social environment for a variety of purposes. Following an evaluation period, a microcomputer based system called Spatial Analysis System (SPANS) developed by Tydac Technologies Inc., Ottawa, Ontario, was selected.

SPANS relatively user friendly command menu allows access to powerful analytical functions, including multiple map overlays, proximity analysis and spatial modeling. The system can integrate data from many sources and will interface to most major GIS's. Satellite imagery can also be incorporated for use with other data bases. SPANS operates on the AT/386 DOS-based microcomputer family. SPANS utilizes a quadtree data structure which allows for the computational abilities associated with raster format systems while allowing for a resolution approaching vector based systems that will run effectively on a microcomputer.

## APPLICATION IN EDUCATION

In Landscape Architecture, much of teaching process in planning and design takes place in a studio environment. Students have the opportunity to apply theory, methods and technology in solving real planning problems. In Winter Semester, 1988, it was decided to integrate the SPANS GIS into a graduate level course, Regional Landscape Planning Studio. In addition to the normal requirements of the course, the students were to learn and apply the new GIS technology to the planning process.

The output of the student work has been published, Eramosa Township Study, and includes regional analysis in determining:

1) Rural residential development potential
2) Natural area conservation
3) Cultural landscape values
4) Small-scale intensive farming potential

The analysis work was done by building a computer-based series of biophysical maps that were manipulated through map overlay processes involving suitablity and conflict models. The students conducted their analysis within the context of retaining the existing prime agricultural land. (The models and map outputwere illustrated at the "Show" portion of the conference.)

Jo-Anne Bennett, a graduate student in Landscape Architecture, used the class as a subject for her Integrative Project, The Development of an Educational Approach and User Guide Notes for the Spatial Analysis System. Her study examined the methods for learning and applying SPANS and make observations on the student progress.

## EVALUATION

Bennett's study and the teaching evaluations revealed a number of benefits of integrating the new GIS technology into a planning studio teaching mode. The students appreciated the exposure to state-of-the-art technology that is rapidly gaining acceptance in professional practice. The powerful analytical capabilities of the system allowed the students to extend their analysis beyond the normal limits imposed by a course of this time period. The GIS model building process forced the students to apply rational, defensible thinking to problem solving. As well, SPANS provides a hardcopy of the mapped results in color which is suitable for inclusion into a final report, thus eliminating the need for conventional drafting.

The disadvantages include the effort required to learn the GIS technology which displaces the time available for analysis and planning. This can be further complicated by the fact that students may not be experienced in using the disk operating system, editing programs or data management packages. As well, a digitized data base is required before conputerized modelling can be undertaken. Due to the extensive amount of material to be adsorbed in a thirteen week period, a higher level of instructional support is required to insure that all students keep up with the class schedule.

Based on the experience in the classroom and Jo-Anne Bennett's study, the following recommendations have been made for conduct of future courses:

1) Computer literacy- a minimum level of computer literacy in MSDOS, word processing and knowledge of the principles of data management are necessary before students attempt using GIS.

2) Support- adequate teaching support is required in a high technology course of this type. This would include a GTA or technologist familiar with SPANS to assist the students.

3) Computer work stations- Adequate SPANS work stations are required during studio instructional periods. One station per four students would be the maximum.

4) Teaching modules- The vendors user manuals are not adequate for instruction. Teaching notes to supplement the technical manuals and sample and/or demonstration data bases are necessary to assist in the initial instruction on the system.

# An Experimental Approach to the Study of Policy: Selected Issues

**Richard G. Townsend**
The Ontario Institute for Studies in Education

For the last dozen years or so, faculties of education in North America have offered doctoral courses in policy for schools -- initially with attention to the standard (and to some extent, misleading) stages of the public policy process -- formation, implementation, and evaluation. Lately, if the literature of this field is any indication of what is actually being discussed in classes, interest also exists in policy analysis, in the meaning of "public interests", in justice and rights while making policy choices, and more. In a sense, all these courses are experimental in that this policy field is young enough that no agreed-upon or traditional way of proceeding exists.

At my institution, I have introduced such a course, but not without facing four issues that I would like to share with you today. My concerns include 1) the course's congruence with other required courses with a Department, 2) the specificity of the course's objectives, 3) the amount of readings, and 4) the learning modes. These issues are hardly innovational -- surely everyone here has dealt with them in their own teaching. So, my hope is that our experiences are common enough along these lines that, different as our work contexts may be, we might profitably share resolutions to these matters.

***Issue 1:*** *How should a course relate to other courses in a program within a presumably unified Department?*

If synergy is a prime goal -- and texbook-writers sometimes claim it is for policies and for departments like mine (of Educational Administration) -- one prescription is that plans at any one level ought to relate to plans at other levels. Thus, a policy course should work in tandem with, or supplement, other doctoral courses in a Department and, at even a higher level, with courses elsewhere in an institution. In my case, I have gifted professorial colleagues who work energetically, resourcefully, even brillantly to help students understand the philosophy of science, the ideological contexts, and the modes of research on school organization -- and organization is the key theme, as that focus almost has become our Department's raison d'etre. Courses with other orientations exist in my unit, but they do not flourish as much as those about organizing schools.

Simply put, my approach towards tieing-in with other courses in my small Department is simply to treat the politics and organizations of educational policy delivery. Although my students and I do explore the environment in which organizations operate, the prime focus is on educational policies and the organizations through which they are delivered.

I'm not sure that this connection is enough, however. Perhaps greater coherence might be achieved if I were to assign the same readings as my colleagues, thereafter working over those core materials with a special policy/political perspective. Our doctoral students, who complain of having to read 500 pages per week per course, certainly would appreciate that approach, and the jointness of our lessons could be truly impressive.

A seasoned coordinator of our program has discouraged me, however, from doing that. Faculty are expected, he says, to have different specialities, texts are expected to reflect those differences, and most importantly, professors relish the autonomy to assign whatever readings they want, without benefit of coordinating committees. The integration between courses goes on, this colleague tells me, "in each student's head" and as each of these students answer questions on our annual comprehensives. So much do I regret that this exam is the only formal experience at synthesis our students have across all their courses that I almost wish I had the energy and skill to persuade my colleagues to work together on some sort of teaching-learning venture (perhaps a workshop over a term? perhaps a fortnight-long blitz activity in April?) whereby students and faculty come together to publicly draw upon all our assorted teachings and learnings.

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(1) This paper was prepared as the "tell" part of a "tell and show" entry for the Second Higher Education "Innovations in Teaching" conference at Guelph University, April 20, 1988.

What we do have, though, is an informal synthesis -- some of those other professors' ideas are so compelling and so dynamically taught that students bring them into discussions during my classes and, to a lesser degree, into papers for my course. Still more term-paper writers would exploit additional other-course ideas, I suspect, if we professors explicity were to welcome such inter-textuality. The rub, I submit, is that the usual student knows that chauvinism for our own domain prompts most academics to value term papers which preeminently work-over our own materials. On the assumption that boundaries between specialities can be paralysing for someone who would understand situations and try to help solve them, is there anything we teachers can do about this?

*Issue 2: What sort of understandings should be cultivated?*

To answer that question in my own milieu, I asked myself, "why policy?" Part of the current popularity of policy courses, I believe, stems from their being seen as possibly helping educators meet the increasing demand for accountability, for coping with situations in ways that realize the goals that elected boards have adapted for accessible education of high quality.

One approach then would have been for my class to study at some length the accountablity movement. Yet I chose simply to offer an early mini-lecture on that theme. More importantly, I tried to capture that timely emphasis by using a hallmark of the accountability movement, the learning objective.

I can recognize an admirable openness in the objective that is stated quite generally -- in a sense, students can be "romanced" as they imagine their own version of what is to be learned. Nonetheless, I hold that a policy course would lack fidelity to the accountability thrust if it offered objectives that were fuzzy as these two (which I have seen in policy syllabi of professors at other universities):

1. To familiarize students with the major conceptual bases and research trends in educational policy
2. To promote the application of a policy perspective as a way of understanding decisions in educational organizations.

So, rather than going with such catch-all objectives, I set down some sought-for "competence expectations." These reflect objectives that I have long valued for learning about policy generation, the foremention policy cycle, and argumentation:(2)

**A. Generating Policy Alternatives To Improve Education:**

1. Understand and be able to evaluate policy documents for their judiciousness and impact for organizations.
2. Be able to conceptualize, acquire information, forecast, objective-set, present options to clients, and design strategies for easing future policy succession and termination within and beyond organizations.

**B. The policy cycle and educational organizations**

1. Understand the educational policy cycle and the need for policy analysis within school systems.
2. Understand the reasons for competing values in educational policy and the importance of "value-critical" policy analysis.
3. Understand the reciprocal relationship between educational policy, the policy cycle, and educational organizations.

**C. Argumentation and Communication within Organizations & The Environment**

1. Be able to sort out propositions that are "interesting" and non-interesting.
2. Be able to make sophisticated policy arguments in a variety of modes.
3. Be able to critique lazy or ineffective writing and to write with clarity.

I have also taken advantage of syllabi of colleagues whom I suspect (from their writings and from my observation of them at paper presentations) to be role-models in their own teaching of the accountablity thrust. Put another way, to supplement my objectives, I adapted certain ideas of two fellow-academics, one in Pennsylvania, the other in California, whose writings I have very much respected. (My hunch is that much borrowing of this sort goes on in teaching "innovations.") The result was the inclusion of two more rather specific expectations as objectives:

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(2) Frankly, you will see here - I might as well face up to it - a certain touch of social engineering, even of technocracy, which I take to be a part (but definitely not all) of the character of policy studies for planners and managers. Foe the sake of balance and synergy in our program, this is a knowing contrast to the orientation of my more philosophical and issue-oriented colleagues who teach doctoral courses in my Department.

**D. Alternative models of policy inquiry and policy models**

1. Be knowledgeable about the characteristics, strengths, weaknesses, and uses of alternative models of (and approaches to) policy inquiry and analysis.
2. Be knowledgeable about the characteristics, strengths, weaknesses, and uses of alternative models, approaches, and ways to deal with issues.
3. Be able to use Elmore's concept of backward mapping in developing policy proposals based on research.

**E. Governance**

1. Understand the policy interactions between top-level administrators and elected officials at thelocal and provincial levels.
2. Be able to explain and contrast alternative theories of innovation and implementation in school districts.
3. Be able to discuss impediments to organizational reform and possible ways of overcoming them.

Responsiveness may be one of the best qualities about a lesson's dynamics, and so consistently I have to wonder: by opting for a specific focus with 5 major competencies that encapsulate 14 particular components, have I frozen out a certain amount of over-the-course flexibility? How have some of you provided sufficient leeway for your classes to look at other topics besides the ones you want to concentrate on?

***Issue 3:** What is the appropriate amount of required reading?*

Generations ago, one of my professors, the humanist Lewis Mumford, used to claim that long reading lists were not essential. He valued term papers that had just one bibliographical reference, if the student had carefully and insightfully pondered that single source and if the student had himself or herself tracked down that article or book. Somehow today, however, I sense that things have changed -- students, expecting to be exposed to the important works in "the field," seem to expect us academics to choose the bulk of the readings. In my policy specialization, though, the literature is so extensive that even if students were to read during a term until their eyeballs fell out, they would only begin to scratch the surface of the available good readings.

My accommodation has been to give them, for future reference, a heavy bibliography and during the course itself to emphasize a) two texts (one looking at policy research and the other rather pragmatically considering components of the policy process), b) about a dozen or so dissertations on educational policy, and c) about 8 other articles. I think this bill of fare introduces policy learners to various dimensions of the (to say the least) eclectic literature while speaking to the assorted "competency expectations" above. I also think this background prepares each of them to present in class (for a written/oral assignment) a perspective on one substantive policy area.

As it usually turns out, about 400 pages are required to be discussed for each session. Roughly, I calculate that this total is commensurate with the sometime graduate-school norm that one has three hours of reading for every hour of class. But even for our full-time students, is this allocation too much? not enough? My colleagues at other universities in this general domain require an average of one text and 18 other articles. (3) Generally, that sum is for master's rather than doctoral courses, but the thought lingers: I may be expecting too much time to be spent over the books -- especially since my students typically are not indefatigable youngsters but sabbaticalling administrators in their 30s and 40s (or, occasionally, their 50s), with families and other routines or pulls away from the university. What to do?

***Issue 4:** To what degree do the learning "modes" facilitate the sought-after competencies?*

Besides lectures, paper-writings, tests, and discussions, probably most of our courses involve various other modes of learning and idea-exchange. I would like to mention here three such "other" formats for promoting inquiry. (4) One is more or less original while the other two build upon the innovations of others.

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(3) See Richard M. Englert, "Portrait of the Politics of Education Field: What Is Written," for an analysis of syllabi for courses, paper presented at the 1987 annual meeting of the American Educational Research Association.

(4) In another place, I have written about a fourth mode for this policy course, and so will not repeat here the end-of-term procedures for trying to motivate students to apply all the course's learnings to a practical problem that they define (with starting points provided by me). See "One Way To Train For the Problems of Administrators," ERIC file number ED 208 473. For a discussion of issues with this approach, see Tom Roby, "Cultivating Habits of Deliberation," in Journal of Curriculum Studies, 1985 or ERIC file number EJ 319 056.

The sub-issue that I identify with each of these modes may be similar to concerns that you have faced in matching pedagogical or androgogical techniques with your bodies of knowledge.

**Sub-issue 1,** involving The Dissertation Defense

Even my "original" mode borrows from another occasion -- the oral defense of a recent dissertation. To learn about policy while being pseudo-socialized to that ultimate assignment of the program, I ask each student to project themselves as the author of one dissertation (which, for the sake of breadth, I usually select). In part, my instructions go like this:

> Consider that you are covering and defending the dissertation before a group of faculty examiners. Be positive about "your" best points and highlights. Say in your own words how they fit into what's generally known about the field.
>
> Then be prepared to be asked harrowing questions about "your" investigation by a random number of the rest of us, posing as faculty examiners. Having also read the dissertation, each of the other class participants should be prepared to raise at least one discerning question with you (our questions are to be different from week to week). We'll have an intellectual justification for our questions too, and we should be prepared to relate the dissertation at hand to the themes on policy research in our text by Paris & Reynolds, Logic of Policy Inquiry. Finally, after this "bear-pit" experience, you -- this time as yourself -- can offer your own pleasures and reservations about the dissertation and its interestingness. Start to walk out of the room if we dawdle for more than 35 minutes on any one of these.
>
> At our second session, I'll role-play the part of Graham Orpwood defending his dissertation on the deliberation of curriculum policy.
>
> As you review these dissertations, observe how the authors introduce their problem, what they coordinate and subordinate, how their methodologies are congruent with their questions, how they write their last chapters (something of an arduous task), and -- not least, since (for one assignment) you'll be writing one yourself for this course -- how they critically review their literature.

Pros and cons of this particular approach should be mentioned. On the plus side, I believe that this process can increase the student's sense of what dissertations, not just on policy, are about. I also believe that this process is reflective of the deliberation process, whereby different interests question each other about the diverse goods and services that are to be served by a policy. On the negative side, the student examiners can ask too-easy questions of student-defenders, anticipating a time when (in exchange) their former interrogators ask them "snap" questions too. An even bigger drawback or strength to this mode is that the task is something that students have not done before, and it requires a little risk-taking.

An issue with any activity is how much time to give it? I sometimes worry that I may trying to squeeze too much into a course, not allowing sufficient "soak in" time for students. But instead of asserting that concern as my sub-issue for this mode -- pacing could be a sub-issue for any mode -- let me refer to a particular consequence of the Dissertation Defense role-play. Taking that risk of format has been an issue for only 3 out of about 65 students. In different years, those 3 individuals chose to simply present a conventional seminar on the dissertation they had been assigned. Instead of putting searching questions to one student "candidate," class-members followed those 3 presentations with observations about the research. Those seminar-like discussions were fair (not outstanding) in quality, but years later, when they finally completed defenses of their own dissertations, these same 3 students still did not fully connect with their real examiners' questions. My sub-issue then is: should I have had such an "escape hatch" for the 3 recalcitrants, or should I have leaned heavily on them to develop some familiarity with a process that was new and therefore stretching for them? Might I have done more to habituate them to the give-and-take of deliberation, dissertation-evolution, and policy? The broad question is, even though one tries to provide a climate of supportiveness for the assumption of new roles, how far can a teacher nudge students to do what they have not done before?

**Sub-issue 2,** involving The Writing Lab (5)

As indicated in the list of competencies above, improved writing has been an intrinsic goal of this course - I hope this investment eases students' progress in writing policy reports in their professional life and through that difficult dissertation challenge, writing. So, in short essays, students take stands on policy articles. This approach is a greatly abbreviated and directed version of an approach developed by Cadwallader and Scaboro. Through the syllabus, I take a more directive role for in-class actions:

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(5) See M. Cadwallader and C. Scaboro, "Teaching Writing Within a Sociology Course: A Case Study of Writing Across the Curriculum," Teaching Sociology, 9 (4), July, 1982

1. For our second class meeting, everyone should read a short section (on cultivating interest) from a book by Karl Weick. It will seem a bit far-out, and you may sharply disagree with it, but from time to time the instructor will return to its themes. A 130-word think-piece, in comprehensive academic language, should be written in reaction to this excerpt. Later in the course and on various assigned days, each should write a 1-page (about 225 words or so) reaction for 3 of the 7 remaining pieces on educational policy. Thus, while reading 8 pieces for this part of the course, each student should write a total of 4 reactions, the one on Weick being a half-page long and the other two being a page long. (Please, do not prepare more than a solitary 1-pager for the same day of class.)

How to proceed? For the Weick essay and three of the 7 other Lab sections, the student should first indulge in freewriting, i.e., unedited, unoutlined, unthreaded reactions to the material. Somewhere in the several pages of this rough freewriting, a generative sentence or phrase will pop up. It should be a pushy and powerful thought, and the writer should organize her/his reaction to the assignment around that generative notion. Extensive rewriting will be necessary -- we're not interested in seeing your first drafts. So, with Strunk & White's style guide (or another style book) in hand, the student should prepare a reaction to the assignment (typed please). Using the Department's xerox facilities, the student should give a copy of this reaction to every member of our class (the instructor included) by 1 p.m. of the Tuesday before our Wednesday class when that article will be reviewed. (Please adhere to the dates on our calendar, attached, i.e., don't "do" a paper that we've already covered or distributed to each other at other classes.) These reactions of yours can be put in our individual Department mailboxes or distributed to each other at other classes.

2. Each of us should read, and jot notes on, all the one-pagers prior to our meeting. Because some preparation time for this is required for sense-making, circulating papers after 1 p.m. on Tuesday is too late. (I regret having to enforce this ground-rule.)

3. At the inception of each writing lab, the instructor will appoint a chair. At that person's bidding, all will read their paper, or a portion of it, aloud. As this process can be a bit like taking one's clothes off in public, the chair not only needs to keep proceedings moving (while discouraging repetition), but to empathize with the naked writer in each of us. If the proceedings are not moving along briskly enough, the instructor ruthlessly will have to step in. The chair should not let people waste our class time by "me too" speeches, as a reader repeats reactions that the writer has already heard.

4. After each reading, the chair will call upon the rest of us to take 1 minute to tell the author, straight on, the impact of his/her paper. As a reader/hearer, offer MUSINGS on the following points:

a. The highs and lows. Say what were the loud words or phrases that jumped out, that stick in your mind. What struck you as soft or weak? Did you feel peaks and valleys? Were there sinks and sources of energy, cold and hot spots? Was the writing flat or bumpy? What "got through" to sustain your attention? Frankly, what didn't?

b. The internal chumings. Give the writer a stream-of-consciousness account of what went on inside you mind during the reading. If you were thinking about something else tell about it. If the writing made your mind wander, the writer needs to know. Consider that a kind of movie is going on in your head connected in some mysterious way to the reading. Inform the writer about that film. Is the movie in your head also the writer's movie?

c. Putting words in the writer's mouth. Simply describe what you think their essay is trying to accomplish. Do not say that the writer succeeded or failed; instead, say what you think he or she tried to do. Then succinctly retell the story in your own words.

d. Stylistic violations of Strunk & White (or of other guides) can be mentioned, but let's not dwell on these.

5. If, after all others have had their say, each author wishes to comment on comments of our group, he or she can respond. This is voluntary and because of time constraints, we probably will be relieved if the writer usually passes the chance by. In any event, we are not interested in elongated defenses from the writer -- at the most, a crisp 45-second reaction to the reactions can carry the day.

Usually as we conduct the initial Writing Lab, the atmosphere is a little tense. But, before long, students seem to "take" to this initiative, the first time in years (some say) they have received close, sensitive criticism of their writing. While the process seems to work without such a complete involvement of the instructor, sometimes I complete the essay-writing assignment too, and welcome musings (which have been helpful) about my communicating too.

An issue involves scheduling of this feature. For a small class of about a dozen, we find ourselves spending 30 to 45 minutes over four or five weeks so musing about the various policy essays. Cadwallader and

Scaboro, the inventers of this approach to feedback on writing, urge that Labs be conducted outside the classroom at various students' apartments, at night, with attendance not required. I have never tried that scheduling, out of fear that students would resist the extra meeting time -- a few commute home every night 75 kilometers or so -- but perhaps such a mutual-aid technique in off-hours would attract the most committed? How far can the instructor go in urging students to get together outside of class so that one person's iron sharpens another?

**Sub-issue 3**, involving The Majority Vote Quiz (MVQ)

Four unique tests are given, but the "marks" are known only to the test-takers themselves. Here again I am adapting, this time Bertil Hansen's suggestions for developing students' abilities at persuassion, (6) which I see as important for success in the policy process. Hansen proposes that the instructor develop each of a certain kind of test, but I only develop the first of this series, leaving it to teams of students to develop the rest from chapters in one of our texts. I believe that the quizmasters learn as much (maybe more) from the exercises as the test-takers.

All the tests are multiple-choice, xerox copies of which are distributed by the responsible team. Test-designers are to take great pains to make sure that their answers are all equally plausible and justifiable. Test-takers identify answers that they believe the most correct.

The quizmasters then lead our class through their questions, one by one. These quizmasters ask for "the" answers and if our responses are ones to which no one objects, they will be pronounced correct without further ado. But if two or more answers are put forward for the same question -- and they almost always are -- quizmasters call for reasons warranting those selections,. As test-takers supply their reasons for preferring one reply over another, quizmasters listen attentively; they taken note of advocacies that are especially compelling. Once all reasons for different answers have been advanced, quizmasters permit a class vote; the choice with the most votes is counted as "correct." Typically, votes shift -- I know my own vote as a participant does -- test-takers often are moved by the logic of their colleagues.

Quizmasters also can award "martyr points" to those test-takers who muster thoughtful answers that are out-voted. Quizmasters are not to award these points just because they regard the out-voted answer as correct, as that would remove an incentive for earning martyr points. Rather, these points are the quiz-masters' means of mitigating injustices done by the majority in overall contexts of in-class dialogue. Further, martyr points are to create incentives for some students to speak up who might otherwise be intimidated by the apparently overwhelming disapproval of their classmates. These points are parcelled out stingily, just as one would apportion any scarce commodity.

For the final two tests, I supplement Hansen and complicate the process, drawing upon a chapter from William Dunn that details "Modes of Advocacy."(7) I assign students to include, as they justify their test answers, a mode of advocacy that they have seemed to under-use in previous sessions. Thus, a student who has been strong in arguing from authority (the "expert" text says so) or value (with an ethical claim about rightness or wrongness of matters)) will be expected to argue pragmatically (from a parallel case or analogical similiarites among relations), or explanatoryily (with a cause-effect relationship), or intuitively from an inner mental state of "tacit knowledge, or analycentrically (arguing from the validity of methods or rules), and so forth. I hand out these assignments the week before so that students have a chance to re-familiarize themselves with aspects of these modes, as described by Dunn. (Elsewhere in the course, they also use these formulations of Dunn.)

By having the students design the tests, the instructor can see what they regard as important and, if appropriate, offer counter-statements or edifications. This process seems to spark involvements with the assigned texts, and discussion often is lively. One slice of evidence, already alluded to, that this approach "works", at least in part, is that this Dunn framework occasionally helps to structure papers that my students turn in to other professors. But there is something of an issue here too: I'm not sure that Dunn's analysis is accepted as true scholarship by a few of those colleagues, however -- a suspicion exists that advocacy is something bereft of a deep (and becoming) theoretical framework. In higher education, how much craft is apt?

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(6)See B. Hansen, "Adventures with the MVQ," Teaching Political Science, 5 (1), October, 1977.

(7) Chapter 4, Public Policy Analysis, Englewood Cliffs: Prentice Hall, 1981.

## A RECAPITULATION

Four questions have been raised about one professor's teaching. In effect, I have asked

1. How should a course relate to other professors' teachings in a program within a presumably unified Department?
2. How specific should we be about the sorts of understandings we set out to cultivated?
3. How much reading is appropriate in courses of different levels?
4. To what degree do our learning "modes" actually facilitate the objectives that we have?

I tried to illustrate elements of that last question by describing three modes that I employ, which themselves can be associated with sub-issues such as these: How far can a teacher go in nudging students to do what they have not done before? How can an instructor go in urging students to get together outside of class so that one of these person's iron can sharpen another? and, In higher education, how much craft or emphasis on tehcnique is apt? While my illustrations have been of a particular policy course within one Department of Educational Administration in a certain professional school, in our conversations I hope that persons outside that milieu might be willing to raise questions as well as share insights and experiences that address those concerns.

# Computer Assisted Learning and Evaluation by QUESGEN

**John Velanoff**
Fanshaw College

- A computer program that can generate near infinite numbers of tests, study-guides and programmed, self-directed learning packages in minutes.
- For every level of education and training.
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- With programmed gradations of taxonomy as selected by the teacher(s).
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## PREFACE

The following is a quotation from page three in the 3rd edition of "Measurement And Evaluation In Teaching," written by Norman E. Gronlund, who is a Professor of Educational Psychology at the University of Illinois. The book was published by Macmillan Publishing Co. Inc., New York.

"Evaluation includes a number of techniques that are indispensable to the teacher...However, evaluation is not merely a collection of techniques - evaluation is a process - it is a continuous process which underlies all good teaching and learning."

## WHAT CAN THE COMPUTER DO?

The advent of modern computer technology now makes it feasible to attain Professor Gronlund's objectives for "good teaching and learning" and his high standards, with a degree of efficiency that was previously impossible except with the extraordinary expenditure of time, effort and money.

The Quesgen program adapts the Socratic method of teaching and learning for implementation by modern computer technology. It requires students to answer questions posed in programmed study-guides with reference to identified learning resources.

The program also adapts the scientific method of the classification and sub-classification of data into organized intelligible form. It does so by storing encoded statements concerning units of study in "files," and then assembles the state-ments on command, into question forms.

There is provision for 98,010 "files" which allow for an equal number of classifications and sub-classifications of data.

The user may encode the data to create testing resources to meet almost any learning objective or to measure specific learning out-comes, including general knowledge, theory, skills, mechanics, procedures, deductive reasoning and problem analysis.

It is an automated tool that incorporates sound pedagogy and extraordinary efficiency.

The word processor/computer can produce multiple choice tests and studyguides based on a number of resources that may be:

a) Directly related to a specific book, chapter and unit of study, as required.

b) Based on booklets, as for example, the Ontario government publication "Marriage As An Equal Partnership" - A Guide To The Family Law Act..

c) Based on employer's manuals for in-service training.

d) Based on case-studies, charts, diagrams or financial state-ments.

You may prescribe scales of taxonomy both in the construction of the questions and in the construction of the statements that make up the questions. The gradations of taxonomy approach infinity.

You may specify the percentage of statements to be taken from any unit of study and thereby "weight" the tests or study-guides.

A copy of the test or study-guide may be printed showing the questions, the answers, and the source of each of the state-ments which form part of the questions. This copy will identify the book, chapter, unit of study, and statement number.

A second copy of the test will be printed showing the questions without answers or sources.

By using permutations and combinations the potential number of questions and tests approaches infinity.

The system is remarkably flexible in that it can produce study guides, programmed self-directed learning resources, and sophisticated tests, all from the same data base.

The Quesgen program will work on a personal computer or on a main frame.

The best evidence by which these claims may be verified is clinical observation.

Ask for a demonstration.

## ADVANTAGES, DISADVANTAGES AND CAVEATS RESPECTING COMPUTER TESTING

1) Valid testing is the sine qua non of effective teaching and it is therefore important to assess the validity of multiple choice tests created by word processors/computers.

Professor Gronlund compares the multiple-choice form with other objective-type test items, and generally prefers the former. He also confirms the validity of the multiple-choice form as a measurement and evaluation tool. Comparisons made between the results of essay-type tests and assignments and the multiple-choice form show that students who scored well on the former, scored equally well on the latter, and vice versa.

We should also recognize that not all skills or achievements can be effectively measured by using either or both methods exclusively because clinical observation and evaluation may also be required.

2) Computerized testing and learning resources should not be adopted to the exclusion of other methods of testing or of other pedagogy generally. There is a real danger that the economies which this type of automation will provide, may be used by some administra-tors to reduce costs at the risk of reducing quality. By the same token, some teachers may choose to reduce their workload at the risk of reducing quality.

The educational value of this technology is its capacity to produce carefully constructed resources more efficiently than otherwise.

3) The system can provide immediate feedback from tests, objectivity, standards consistency, easy maintenace of the records of student progress, and increased test security.

4) The system can be adapted to almost any discipline or subject of study. Samples are available for examination on request.

5) Other programs can be developed and integrated with Quesgen which will enable students in the future to requisition tests individually, write such tests, and have them evaluated immediately. The result of the test or tests would be stored in the computer files in order to keep a record of these students' progress and accomplishment. The ultimate goal of making it possible for all persons to proceed toward accreditation at their own speed in accordance with their own needs and exigencies, is within reach.

6) With Quesgen, it is quite possible to provide tests on demand without any great inconvenience to either the teacher or the administration. You may allow students to write as many tests as they wish and to give them credit for their achievement regardless ofhowmanytestshe/she may havewritten.

   Upgrading need not be withdrawn as long as the student wishes to make the effort. It would be logistically impossible to provide this accommodation for students if it were not for the fact that the system substantially reduces the drudgery of creating questions, and tests, and of marking them.

7) Because of the potential number of variations, there should be no concern about students keeping their copies of the tests; as was indicated in the preface, the number approaches infinity. In fact, students should be encouraged to keep their copies as part of their notes for study and review purposes.

8) The ease with which tests are created and the consistency of their taxonomy also make it possible to have a large number of students write a test in the same room, but with a number of variations which will make it futile for students to signal answers back and forth. Invigilation is more effective and less expensive.

9) Most teachers dislike the role of judging who shall pass and who shall fail, both because they are not so confident of evaluation methods and techniques that they believe they are always accurate and fair; and also because they prefer to leave an option open to students to improve their grades by their own efforts. By making the opportunity for rewrites, or upgrading tests, available on demand, the student becomes much more the author of his own fate. This is as it should be, and the option for upgrading should never be withdrawn as long as a student wishes to make the effort. It is much easier to achieve this ideal when computer testing is available.

10) By using case-studies as part of a workbook or study guide, the student can be directed to apply the knowledge gained in the lessons. Questions can be based on the case-studies in the same increasingly comprehensive and complex way as for the lessons or units of study themselves.

    Flow-Charts, diagrams, schematics, illustrations of all kinds, and even complicated mathematical problems and formulae can be presented in the same way.

11) Most people find it difficult to read AND ABSORB text material or technical manuals unless they are highly motivated to do so. A well designed study-guide requires a student to look for the answers to specific problems in their learning resources. Their ability to concentrate on the text material is substantially enhanced with this learning aid.

12) The improvement of self-directed learning resources leads to improvements in facilities for disadvantaged or handicapped persons who may be confined to their homes or are otherwise, limited as to their mobility. Persons whose access to learning is restricted by the remoteness of their location, can be brought into direct contact with these resources with relatively small cost. If a telephone is available, they need only a modem and an inexpensive word processing setup in order to access what can be a vast educational facility.

13) Integrated learning and testing by which related subjects are tied in to the main course of study, is more easily accomplished when a study-guide and tests are generated by computer. For example, if the primary objective of a course is an understanding of the principles of marketing, the secondary objectives

would include an understanding of the influences created by laws, economic conditions, sociological conditions and psychological factors, to mention only a few prominent ones. You may create study-guides which draw questions from all of these areas of study and weight the degree of imput as you direct.

Study guides and case-studies can be tailored to individual or small group needs, and the mechanisms now available make this economically feasible.

14) Team-teaching can be significantly enhanced by integrating each specialized presentation to the others as above, and by designing case-studies which expand to include problems based on each specialized unit of study as it is presented.

15) "Table-top" publishing can create resource material which may also be accessed by modem and reproduced as needed by the user. Learning resources can, thereby, be made available using a "shopper's mart" concept as a marketing device. A catalogue of resources can be made available through the computer, and the user may then select the combinations of units of study which meet his/her individualized needs as set out in course outlines. They can be reproduced under licensing arrangements and printed locally in quantities as may be required.

16) These resources can be made available from central sources to any user, whether that be a person, corporation, educational institu-tion, certifying body, or government agency, by using the technology as described above.

17) In this era of rapidly expanding technology and automation, the need for retraining becomes inevitable. In many cases the candi-date has achieved advanced standing in the school of hard knocks, but has very little formal qualification. In order to assess a candidate's entry level, the availability of computerized testing on demand has obvious advantages. The individual can be provided with study-guides and resource material, and when he/she wishes to write a test to determine the level that has been reached, the opportunity is readilyavailable, as are repeat attempts.

The same can be said about persons who may need to acquire a prerequisite to qualify for a program of studies.

18) For the protection of society, governments are finding it to be increasingly necessary to regulate service industry by requiring persons who make it appear that they have the knowledge and skills to advise or represent people, to prove their qualifications by meeting certain standards. A case in point is a recent bill presented to the Ontario legislature to qualify and regulate "paralegals." Some persons have been practising as such for decades. Computerized testing, as described in this manual, can go a long way toward determining existing standards by which qualifying standards may be established. Having made this deter-mination, the qualifying agency can then adjust the standards to suit their purposes.

Refresher courses and upgrading facilities are much more accessible to persons in all parts of the territorial jurisdiction of the licensing agency.

19) On completion of a test by students, it may be marked by computer. The results, and a complete analysis, can be made available within the hour.

20) You may develop and use your own data bases with your own coding.

## CODING

The parameters for coding are built into Quesgen. It provides for 10 books, with 99 chapters in each book, with 99 units in each chapter.

"Books", "Chapter", and "Unit" are simply nomenclature, and you may put any name on your classifications that you wish.

If you use "chapter" in its ordinary context, Quesgen allows you 99 classifications of statements that you may wish to create with respect to the chapter. It is important to remember that you are not restricted to classifications that are based on the understanding of theory, and there are many alternatives as described above.

## UTILIZATION OF YOUR DATABASE

**a) Practice and Pretests**

Most students are not familiar with the type of tests that are generated by "Quesgen", nor are they familiar with the diagnostic value and implications of the "T.E.S.S." scoring system, described on page 9. Once your data base is in place, it takes less than a minute to generate a practice test and about 30 minutes to have your students write it. A good practice is to allow the students to do so anonymously by adopting pseudonyms which enable them to ascertain their individual results without identifying themselves.

This can serve two useful purposes; (i) When you get back the analysis of the test result from "T.E.S.S.", you can explain its interpretation of the data and its applications to the class so they may understand the objectivity of the testing, and its diagnostic value. They will appreciate then that the testing is an integral part of learning. (ii) It will also enable you to assess the class's level of understanding of the subject.

**b) Mini-Tests**

"Quesgen" and "T.E.S.S." make frequent testing and marking simple and almost effortless.

**c) Study-Guides**

A well designed study-guide will enable your students to read and absorb the instructional material. This conclusion is based on the premise that a person's ability to concentrate on texts or technical manuals will be greatly enhanced if he/she is looking for the answers to specific problems.

In short, a teacher can design a study-guide according to his own specifications that will best meet the needs of a group of students for whom he/she is responsible, and vary them for other groups.

Study-guides may be created from a combination of any or all of the statement files that YOU create. And most importantly, these "tailor-made" study-guides can be created in far less time than it takes to prepare an ordinary 4 or 5 page course outline.

## PROGRAMMED SELF-DIRECTED LEARNING PACKAGES

The essential differences between learning packages and ordinary study-guides is that the "Packages" might include the following:

(i) A summary of the text material or the text itself.
(ii) The test items and exercises as in the study-guides.
(iii) The solutions and a short explanation of the answers.

All of the foregoing can be transmitted electronically to learning centres in remote locations or directly to students who may happen to be handicapped, IF ON-LINE EQUIPMENT IS AVAILABLE.

It takes a telephone, a modem and a micro computer with printer. But clearly, the data base must be researched, developed and field tested.

## TAXONOMY

1) The statements in the questions themselves may be simple, for example, 2 + 2 = 4; or complex, for example, E = MC

2) The construction of the questions may be simple, i.e., True/False or complex, i.e., with three or more distractors.

3) The subject matter of the questions may be simple, i.e., drawn from one unit of study, or complex, i.e., drawn from two or more units of study.

4) The questions may be created with three or more distractors; from two or more units of study; and from statements that are simple or complex, ... as the user may direct.

5) The knowledge acquired may be applied by employing case-studies, which in themselves may be classified as in 1, 2, 3, and 4.

6) The following types of learning outcomes may be programmed into the data base:

1. KNOWLEDGE
   - 1.1 Terminology
   - 1.2 Specific facts
   - 1.3 Concepts and principles
   - 1.4 Methods and procedures

2. UNDERSTANDING
   - 2.1 Concepts and principles
   - 2.2 Methods and procedures
   - 2.3 Written material, graphs, maps, and numerical data
   - 2.4 Problem situations

3. APPLICATION
   - 3.1 Factual information
   - 3.2 Concepts and principles
   - 3.3 Methods and procedures
   - 3.4 Problem-solving skills

4. THINKING AND READING SKILLS
   - 4.1 Critical thinking
   - 4.2 Scientific thinking
   - 4.3 Logic and Deductive Reasoning

5. GENERAL SKILLS
   - 5.1 Laboratory skills
   - 5.2 Performance skills
   - 5.3 Communication skills
   - 5.4 Computational skills
   - 5.5 Social skills

You may become the composer/arranger of learning resources.

## TEST REQUISITION

The following is a hypothetical requisition for a test which illustrates the criteria that you may input into the design of a test.

Title - Laws 103
Date - 88-01-29
Instructor - Socrates
Number of questions required (40)

Specify the units of study

| Book | Chapter | Unit | |
|---|---|---|---|
| 1 | 1 | 1,2 & 3 | |
| 1 | 2 | 1 & 2 | (you may specify up to 10) |
| 1 | 3 | 1 | |

Do you wish to emphasize any particular units? Yes or No Yes

If so specify the unit(s) and give an approximation of what percentage of the statements in the test that you wish to draw from that/those units.

B1-C1- Unit 1 - 20%
Unit 2 - 20%
Unit 3 - 20%

B1-C2- Unit 1 - 15%
Unit 2 - 15%

B1-C3- Unit 1 - 10%

100%

Specify the Difficulty Level(s) required
(the range is 1 to 10 but these may be compounded as the requisitioner chooses)

| Level | Number of Questions |
|---|---|
| 1 | 10 |
| 3 | 15 |
| 4 | 09 |
| 5 | 03 |
| 6 | 03 |
| Total | 40 |

Quesgen will generate your test based on these criteria in less than one minute.

## T.E.S.S. - THE TEST SCORING SYSTEM

T.E.S.S. will provide . . .

### A - Student Grades

The printout provides this data in descending order, ascending order, alphabetical order, or in numerical order if the student numbers are used to identify the candidates.

INDIVIDUAL STUDENT INFORMATION--The printout shows a "line score" for each student indicating the answer that was given on every question. If the right answer was given the printout shows a dot; if the wrong answer was given the printout shows the letter which was given as the answer; if no answer was given there will be a dash; and if a multi-answer or invalid answer was given there will be a question mark.

### B - Statistical Data

This includes a statement of the high, the low, the median, and the mean mark. In addition, the printout shows the distribution of the marks from 0 - 100 by specifying how many score in the 90's, 80's, 70's, etc.

### C - Questions Information

The printout shows the question number, the answer as inputted to the computer, the number of students who chose answer A, B, C, D, or E, and how many gave no answer or an invalid answer. An invalid answer may be a double answer where the student did not cleanly erase a choice and made a second choice, as a result of which the computer picks up both.

The program will accept two or more choices as an answer, in which case a student who only gives one choice would be marked wrong.

### D - Questions Difficulty Level

The computer gauges the difficulty level of each of the questions on the basis of the success or failure of the class in answering it. A range is shown from 100 for the top or easiest questions, descending to a minus quantity for the ones that are found to be very difficult. This indicates that it may not have been very well covered in the lessons. On the other hand, it may be an indication that the question is particularly difficult or unfair, in which case the teacher has the option of disqualifying it.

DISCRIMINATION INDICES--The computer printout rates the ability of each question to distinguish between the top students, and students in the bottom half of the class, in the sense that one would expect the top half to do better on each question. The range shown in this index is from -1 to +1 and if the top half has done better than the bottom half, the figure shown will be a plus quantity; whereas if the bottom half did better on a specific question than the top half, the numerical quantity shown would be a minus quantity. This serves to alert the teacher to the need to check the question and see whether there are any ambiguities.

In addition to an analysis of how effective each individual question is in distinguishing between top and bottom half, the printout also shows the discriminatory ability of each of the statements that make up the question. This is done by showing what percentage the top half of the class gave as answers and what percentage the bottom half gave as answers. We expect that the bottom half would choose the wrong answer more often than would the top half.

The foregoing data will be made available within an hour if some urgency is shown, but the normal turn around time is overnight.

## PHILOSOPHY 102 and 202 PROJECT

The following is the result of the experimental use of a programmed study-guide provided to students at Fanshawe College of Applied Arts And Technology in London, Ontario. The students were enrolled in a General Arts And Science Program and the course was Philosophy 102.

One study-guide was created by Quesgen during the fall semester, 1987, based on the last half of the course. A copy was provided to each member of two classes AFTER their mid-term test. Other than this resource, no other changes in methodology in the presentation of the course were made, and no other learning resources were provided, beyond what was already available to the students.

They wrote their final test on December 15th, which was identical to the mid-term, as to the number of questions, their, make-up, and the taxonomy levels. A comparison of the results shows a dramatic improvement as follows:

| Mid-Term Test - | Median Mark | High | Low | A's | B's | C's | D's | F's |
|---|---|---|---|---|---|---|---|---|
| Class A | 53.5% | 84 | 28 | 1 | 1 | 4 | 9 | 9 |
| Class B | 50.375% | 80 | 32 | 1 | 1 | 6 | 6 | 18 |

| Christmas Test - | Median Mark | High | Low | A's | B's | C's | D's | F's |
|---|---|---|---|---|---|---|---|---|
| Class A | 69.14% | 96 | 36 | 7 | 3 | 6 | 2 | 3 |
| Class B | 68.29% | 96 | 44 | 6 | 7 | 9 | 4 | 2 |

A preliminary survey of the class, as to the availability of the study-guide and its value, was done after the final test. The students were almost unanimous in crediting the availability of the study-guide for their improved performance.

An increase of approximately 35% over the mid-term test is quite remarkable, but some of that may be due to the fact that the students became more familiar with computerized testing as a result of the mid-term.

For the winter semester, we made study-guides available for the entire Philosophy 102 course and for its sequel, Philosophy 202.

In the introductory Phil 102 course the median mark in the midterm test was 64 and the mean, or average, mark was 66. In the final test, these improved to 72 and 69 respectively.

In the sequel Phil 202 course, some of the students had not taken the introductory course and their mid-term marks reflected this fact. The median was 48 and the mean was 51. However, the final test showed dramatic improvement to a median of 64 and a mean of 66.

The final grades distribution is significant:

| | High | Low | A's | B's | C's | D's | F's |
|---|---|---|---|---|---|---|---|
| Phil 102 | 96 | 30 | 6 | 7 | 5 | 5 | 3 |
| Phil 202 | 98 | 30 | 7 | 2 | 0 | 3 | 8 |

The students who achieved the A's were almost unanimous in crediting the study-guides for their success. The teacher stated categorically that he had never experienced so many A's in his many years of teaching the subject, and he noted that the number of A's was not due to high average marks for the classes as a whole.

Furthermore, many students improved their marks dramatically when they used the study-guides as directed.

In one case a student had 16 on the midterm and 96 on the final!

In another, it was 36 improving to 100!

We are continuing our experiments in other disciplines and will, therefore, have the results of broader based research with much larger samples.

## SUMMARY

1. Computerized testing is far more advanced than we realize.
2. The Taxonomy of tests can be metered so as to meet standards fixed by educational institutions, vocational and professional associations, and as required by industry. They can be main-tained on local, regional, provincial, a Canada-wide scale, or world-wide.
3. Test Objectives can be more comprehensive thanotherwise.
4. The ability to create comprehensive course outlines and study-guides for conventional education is greatly enhanced. They may include the creative use and effectiveness of case-studies, flow charts, schematics, diagrams and other devices. Industry can improve the effectiveness of their technical manuals, instructional guides, or even policy manuals with study-guides based on them.
5. The correlation between "conventional" test results and computerized test results is remarkable.
6. Testmarking,andfeedbackforstudents, areaccelerated.
7. The frequency of testing can be increased without increasing teaching costs, or teachers' workload.
8. Student progress can be monitored much more closely than with conventional methods.
9. Up-to-date Student Records can be maintained efficiently, and inexpensively.
10. Teacher evaluation can be more objective, consistent, and con-structive. Teacher accountability can be measured.
11. The economies are potentially astronomic, and can be effected without reductions in quality.
12. Opportunities for productive class discussion are enhanced when tests are taken up immediately after they have been written. The Socratic method of teaching has been adapted and enhanced by automation.
13. Progress toward self-directed learning can be realized.
14. Remote learning and access to learning for handicapped persons becomes a reality.
15. Table-top publishing can reach out to remote areas and bring copies of learning resources within the reach of millions of people who could not otherwise have access.

# C.A.I. Modules in Soil Science

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## INTRODUCTION

**Principles of Soil Science** is an introductory course offered during the first year to students in the Agricultural Diploma Program at the University of Guelph. While all the students have a minimum grade 12 education, some also may have come from the degree program and even have completed their degrees, the majority have no previous exposure to soil science and there are many with minimal background in science. It is difficult, if not impossible, to present the course material in a lecture format to students with such widely varying backgrounds and meet all the needs of a class of 150 to 200 students. In addition, besides the usual lack of good study habits and varying interests in the course material that are typical of many students, a portion of the class has diagnosed learning disabilities, and require more individual attention. To meet the needs of all the students, we have elected to develop computer-aided instructional modules for the course using VITAL (Versatile Interactive Teaching and Learning System).

## ABOUT VITAL

VITAL offers independent learning that:

(a) provides a non-threatening learning environment
(b) is time and location independent
(c) gives individual attention to each student
(d) indicates the level of mastery of the subject matter achieved by the student

We have designed the modules to be highly interactive in order to capture the attention of the students and motivate them to complete each module. The student must respond to questions to proceed through the module and receives immediate feedback, either acknowledging a correct answer or directing to remedial information. The VITAL modules are meant to complement the lectures allowing more motivational examples of the basic course material to be presented in class. Use of VITAL by students was not made compulsory for completion of the course requirements.

## FEATURES OF THE LEARNING MODULES

Each module contains a single specific learning objective which, including a self-test, can be completed within a relatively short time, usually less than 10 minutes. This gives the student an early sense of achievement which is essential for motivation and learning; it also allows students to easily complete a module during breaks in their regular class scheduling.

The student controls their own flow through the module by electing from a Choice menu: the particular pathway selected depends on whether the student would like to use the module to cover material for the first time, continue through the module, review previous material, complete a self-test or exit the module. Immediate feedback and suggestions are provided for each student's response. If the questions are not answered correctly, the student can be directed to review material or to remedial exercises.

## STUDENTS' REACTION

The response to VITAL by students, based on comments made in student evaluation, was generally very positive. Some of the comments were "I liked VITAL" and "More VITAL modules!". However, more than one-third of the class did not use VITAL. Furthermore, while all the top students worked through the VITAL modules, more than one-half of the poorer students did not complete all of the VITAL modules; some of these students did not use VITAL at all. It thus seems that the better students have taken full advantage of this new technology while the students that could benefit most have been slow to adopt it. Our effort now has to be directed to ensure that those students which need more help, choose to use VITAL.

# University Industry Co-operation in Teaching: An Example in the Field of Modern Analytical Chemistry

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For the past several years many post-secondary educational institutions have been unable to purchase sufficient equipment to ensure adequate state of the art practically significant in the case of the institution such as the Ryerson Polytechnical Institute which has primarily built its reputation on the excellent practical skills of its graduates.

Recently, in the field of chemistry, this situation has become increasingly difficult as analytical instruments have become automated and the results generated by these instruments are stored and manipulated by microcomputers. Typically, the senior undergraduate teaching laboratory will contain instruments which do not have autosamplers and which are rarely controlled by computer systems. Small amounts of data are generated in the experiments and this data is displayed by meters, chart recorders and possibly simple microcomputers such as reporter/integrators. There is no storage of experimental data and data reprocessing is not used as a means of solving practical problems. In general, the major emphasis of the laboratory session is on the chemistry of the analytical method and also often includes the physical and/or the chemical parameters involved in the analytical instrumentation.

In contrast, a modern industrial laboratory analysis system will frequently include an autosampler, computerized instrument control, dedicated microcomputers for data storage and reprocessing and, in some instances, a laboratory mainframe or minicomputer and/or a network connecting instruments and microcomputers. Unfortunately, due to inadequate capital equipment budgets, todays graduate will generally have had little experience with this modern equipment the use of which requires not only analytical chemical knowledge but also dedicated computer skills and a familiarity with the principles of automatically analysing or producing large numbers of samples.

This presentation describes a short lecture/laboratory module which was included in the third year of the Bachelor of Technology (Laboratory Sciences) program in a partial attempt to bridge the gap between the teaching laboratory and the working world. The necessary modern equipment was not available on campus either for teaching the students or for the faculty to develop the course material. It was, therefore, essential to secure the assistance of a major manufacturer of analytical equipment both to develop the course content and to present the material to the students.

The course module consisted of two lecture hours and a three hour practical session. Both the lecture and laboratory sessions were developed co-operatively by the faculty member and a technical representative from the equipment manufacturer. The lecture sessions were presented by the faulty member and the laboratory sessions were led by two technical personnel from the industrial corporation, who also supplied, demonstrated and supervised the students' use of the equipment.

The major focus of the lectures was a review of the commonly available chromatography data management and instrument control systems with emphasis being placed on the equipment which was to be used in the practical session. The practical session introduced the students to chromatographic problem solving by using data reprocessing with two types of data station. The data stations were not connected to analytical instruments and data from chromatographic runs was pre-stored in the computer memories prior to the practical session. Apart from convenience, this approach focused the student's attention on the data manipulation aspect of the experiment rather than on the chemical analysis, however, knowledge of the principles of chromatography was essential to carry out the experiments.

The reason for developing course material in this way is to give senior students the necessary exposure to modern state of the art equipment which is not available on campus.a However, in addition to this major objective, some additional advantages were found. These included:

1) the experiments were based on the experience of the technical personnel in their field work and included the errors most often made by users of this equipment
2) the students learnt from young scientists with a high level of technical expertise (role-models)
3) the equipment costs and other operating costs (not labour) for the practical sessions were nil and
4) the faculty member had the opportunity to learn first hand about the equipment, to work with it, and to gain a complete knowledge of its potential.

There are, however, two possible disadvantages to using this approach for solving the practical problem of a lack of available modern equipment. The major disadvantage is that it requires a large amount of faculty time to become familiar with the equipment and to develop course material jointly with external personnel. The minor problem is a timing problem. In general, equipment can only be borrowed for teaching purposes when it is not needed for other purposes. This can mean that the order of all the course material is dictated by the availability of one set of equipment and may not be the most satisfactory for the overall course. A further aspect of this problem is that the faculty member will generally have to fit in between the company representatives' other commitments both in developing the course content and in presenting the material. Unfortunately, this may not always be possible. Nevertheless, the particular course material described here, was found to have provided a very productive and positive experience for both the students and for those of us who were involved in its preparation and presentation.